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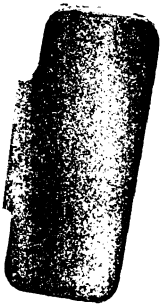


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# **DIRECTIONAL ASTROLOGY**





# DIRECTIONAL ASTROLOGY

TO WHICH IS ADDED A DISCUSSION OF  
PROBLEMATIC POINTS AND A COM-  
PLETE SET OF TABLES NECESSARY  
FOR THE CALCULATION OF  
ARCS OF DIRECTION

BY

SEPHARIAL

AUTHOR OF

"COSMIC SYMBOLISM," "A MANUAL OF ASTROLOGY,"  
"A MANUAL OF OCCULTISM," "THE KABALA OF NUMBERS,"  
"KABALISTIC ASTROLOGY," ETC.

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## PREFACE

A WORD by way of introduction to this work may be necessary, inasmuch as it deals with a technical subject, and the scope and purport of it cannot very readily be apprehended by the casual reader. It is essentially a book for the astrological student. To the astronomer it is particularly informing in that it brings out the more scientific part of the subject and shows the mathematical basis underlying the "lucky hits" to which many of our astrological exponents have undisputed claim.

The general scope of this work embraces all that is essential to the art of "directing" as practised by Claudius Ptolemy and Titus de Placidus, and more recently by Sir John Wharton, Mr John Gadbury, Commander Morrison, R.N., and Mr A. J. Pearce, all of whom pursued the same general principles of astronomical directing, and differed considerably in their application of the celestial arcs to the measure of time. These points are reviewed and critically examined in the following pages.

An attempt having been made to bring the Arabian system of a day for a year into accord with the astronomical system of a degree for a year, some suggestions have here been made as to their rapprochement, the feeling being that, where credit is claimed for one system over another by exponents of either, the probability is that there is truth in both and hence there must be a co-ordinating factor. In the attempt to scientifically extend our horizon to include a prescience of coming events, we have primarily to remember that there are many ways up a mountain, but there is only one top. A study of these various methods may lead to the conclusion that they are all leading in the same direction. It is as if one should say there are three hundred and sixty paces from end to end of the path, and another should say that there are three hundred and sixty-five. Both may be right according to their count and the measure of their tread, but the actual length of the path will remain the same whatever they make of it. This pathway is that which a man has to travel from his cradle to his grave; and there is nothing that concerns a man so vitally as that he should know its trend and gradient, its pitfalls and rocky eminences, in advance of his going, so that experience may be laid by the heels and made to serve instead of to subjugate. And in the direst extreme of human experience we have to remember that "the wise man foreseeth the evil

and obscureth himself, while the ignorant pass on and are hurt."

I have used a well-known and thoroughly authenticated horoscope for purposes of illustration, and anybody following the rules here given in relation to that horoscope will have no difficulty in following them out in respect to any other horoscope. Particular care has been taken to define the principle underlying each operation, and to give a clean-cut rule of procedure. Unlike most authors, who proceed by befogging the mind of the student with technicalities and afterwards explaining them by means of an appendix, I have devoted the first chapters of my work to technical definitions which are essential to the proper understanding of the subject; and until these are clearly apprehended and understood, the student need go no further.

To save further expense and trouble, my publishers have completed my work by the insertion of a complete set of tables, which include tables of Right Ascension and Declination for every degree of the zodiac, together with the ascensional difference due to the latitudes of London, Birmingham, and Liverpool under the present obliquity of the Ecliptic; also tables of Sines and Tangents, and tables of Proportional Logarithms. These are all that are essential to the present treatise, and in themselves constitute a very valuable addition to the volume. It is, of course, presumed that the

student of "Directional Astrology" will have mastered the preliminary task of setting a horoscope for any given time and place with adequate precision, and hence that he is familiar with the use of an ephemeris. The present work is intended to replace and supersede *Prognostic Astronomy*, which is now out of print.

Beyond this I have nothing to say, save that I trust to have done my work efficiently and to have left no point on which a reader need question me. In such case the work may be regarded as complete, and so I hope it will be found.

SEPHARIAL.

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# Directional Astrology

## CHAPTER I

### ASTRONOMICAL DEFINITIONS

THE following definitions must be fully understood by the student before the more intricate part of the system of directing is undertaken.

*Longitude* is of two kinds : longitude in the Orbit, and longitude in the Ecliptic. The latter is the only one recognised and used in this system. It is defined as distance from the vernal equinox, Aries 0, measured on the plane of the Ecliptic or Sun's path.

*Latitude*.—Celestial latitude is distance north or south of the Ecliptic.

*Declination* is distance north or south of the Equator. The Ecliptic lies in declination  $23^{\circ} 27'$  north and south.

*Right Ascension* is distance from the vernal equinox measured on the plane of the Equator. Right ascension thus answers to geographical longitude in the same way as declination answers to geographical latitude.

*Meridian Distance* is the distance of a celestial

body from the midheaven of a place ; that is to say, from its meridian, measured in right ascension.

*Semiarc* of a planet is half the time it remains above or below the horizon of a place, measured in degrees of right ascension. The diurnal semiarc is half the arc in right ascension of a planet above the horizon, and nocturnal semiarc is half the time it is (measured in right ascension) below the horizon. The diurnal semiarc taken from  $180^\circ$  will give the nocturnal semiarc, and the nocturnal semiarc taken from  $180^\circ$  will give the diurnal semiarc.

*Horizontal Arc* is the distance in right ascension from a body to the point of its rising or setting. The semiarc less the meridian distance is always the horizontal arc.

*Oblique Ascension* is the right ascension of a body increased or diminished by its ascensional difference, according as its declination may be south or north. In northern latitudes the right ascension is increased for a body having south declination and decreased for a body having north declination, but the reverse of this is the case in southern latitudes.

*Ascensional Difference* is the time (measured in right ascension) that a body is above or below the horizon more or less than six hours. If, therefore, its semiarc is more than  $90^\circ$  the excess of  $90^\circ$  is its ascensional difference. All bodies that are not exactly on the equinox (Aries 0 or Libra 0) have ascensional difference. For a planet in south declination the ascensional difference is added to

its right ascension to get its oblique ascension, and for bodies having north declination the ascensional difference is subtracted. The reverse of this gives the oblique descension. The O.A. plus or minus  $180^\circ$  gives the obl. descension of the opposite point.

*Pole of Latitude.*—The pole of a place is the same as its latitude. The pole of a planet is measured by a circle of position or small circle parallel to the meridian of a place. The pole of the ascendant is the same as the latitude of the place, and this diminishes as we reach the meridian, where it is 0.

*Direction* is the process by which we bring the body of a planet to the longitude or body of another in a different part of the heavens either by its rising or setting, and this direction of one body to another, or to the place of another, is measured in right ascension; that is to say, by the number of degrees which pass under the meridian of a place in the interval. All directions are taken in the prime vertical, or circle of observation—that in which a person stands upright facing south. Having the proportional distance of a planet between the meridian and horizon, we may bring another body to the same proportional distance along its own arc until it appears to be in the same relative position as the first body. This supposes that the position and influence of a planet is indelibly located in that part of the heavens in which it was found at the moment of birth. All arcs of direction are measured in right ascension.

*Significators*, in this scheme, are the Midheaven, Ascendant, Sun, and Moon. These are the bodies or positions that are directed or moved in the prime vertical in order to form conjunctions, oppositions, and various aspects with other positions and bodies. They are called "significators," from the fact that they are found to signify certain things in the life of an individual; as, the Sun signifies male relationships, the Moon female relationships, the Midheaven honour and position, credit, etc., and the Ascendant the health and general play of events in the individual sphere of life. For further elaboration of this point refer to the *Text-book of Astrology* or *The New Manual of Astrology*.

*Promittors*.—These are the planets Neptune, Uranus, Saturn, Jupiter, Mars, Venus, and Mercury. The Sun and Moon may also be classed as promittors when the Midheaven or Ascendant is directed to them.

*Logarithms*, invented by Baron Napier of Merchiston, first-class mathematician and astrologer, were designed for the purpose of simplifying calculations in spherical trigonometry. In this scheme the arc of  $90^\circ$  of a right sphere is made to equal 10.00000, which is called the radix. Then, having the logarithm of any arc, it may be multiplied into any other arc by simple addition of their logarithms; and, similarly, arcs may be divided by one another by subtracting one logarithm from another. Napier thus emphasises the fact that multiplication is

merely the addition of a number to itself a given number of times, while division is merely subtraction a number of times. Then by means of a proportional circle we can multiply and divide any arc by simple addition and subtraction. The complement of an arc is what it lacks of  $90^\circ$ , and as this is equal to the radix 10, the complement of a logarithm is what it lacks of 10. Thus the logarithm of the sine of  $32^\circ$  is log. sine 9.72421, which is also the log. cosine of  $58^\circ$ , because 58 is the complement of 32, both together making 90. The arithmetical complement of the logarithm is 0.27579, since this, added to the log. sine of  $32^\circ$ , makes 10.00000. Familiarity with the use of logarithms will readily establish their great value in all mathematical calculations connected with the sphere.

I may now ask the reader to take in hand an ephemeris for the current year, 1916, and turn to the 1st January, and the above definitions may then be illustrated.

Let us suppose that a birth took place at noon, Greenwich mean time, on that date in London. The ephemeris being calculated for mean noon at Greenwich, there will be no equation of time necessary. The Sun, Moon, and planets will be in the positions indicated in the ephemeris. The Sun's longitude is seen to be Capricornus  $9^\circ 45' 14''$ . The Sun never has latitude, inasmuch as it defines the Ecliptic, distance above or below which constitutes celestial latitude. All other bodies have

latitude except when they are on that point where their orbits cross the Ecliptic, that is, their nodes. The course of the Sun being across the plane of the Equator at an angle of  $23^{\circ} 27'$  it will attain that declination at the solstices; that is to say, on the 21st June and the 22nd December. On the 1st January it is found to have declination  $23^{\circ} 6'$  south of the Equator, and, therefore, would be immediately overhead at noon at a place which had geographical latitude  $23^{\circ} 6'$  south, and the Sun's diurnal course around the Earth would follow this parallel of latitude. The Sun's right ascension (R.A.) can be found in the tables (see Appendix) from its longitude.

*Rule 1.*—To find the R.A. of any body without latitude.

From the log. cosine of its distance from the nearest equinox subtract the log. cosine of its declination. Remainder is the log. cosine of its R.A. from the same equinox.

*Example :* The Sun is here  $80^{\circ} 15'$

from Aries 0	cos. 9.22878
Its declination is $23^{\circ} 6'$	cos. 9.96370

---

Distance in R.A. from

Aries 0 = $79^{\circ} 23'$	cos. 9.26508
----------------------------	--------------

Therefore from  $360^{\circ}$  take  $79^{\circ} 23'$ , and the R.A. of the Sun is thus found to be  $280^{\circ} 37'$ . Note that it is sufficient for our purpose to take the various quantities to the nearest minute of space.

Now take the Moon's place in the ephemeris, which is seen to be Scorpio  $17^{\circ} 54'$ . This is  $47^{\circ} 54'$  from Libra 0. The declination of the Moon is  $22^{\circ} 7'$ . Reference to the tables will show that the declination of Scorpio  $17^{\circ} 54'$  is  $17^{\circ} 10'$  only, and we therefore know that the Moon has latitude and is not on the Ecliptic at this time. The ephemeris shows it to have  $5^{\circ} 9'$  of south latitude. In finding its R.A., therefore, we have to take this latitude into account.

*Rule 2.*—To find the R.A. of a body having latitude.

Add the log. cos. of its distance from the equinox to the log. cos. of its latitude, and from the sum subtract the log. cos. of its declination. The remainder is log. cos. of its R.A. from the same equinox.

<i>Example :</i>		Moon's distance from	
	Libra 0 = $47^{\circ} 54'$	.	cos. 9.82635
	Its latitude is $5^{\circ} 9'$	.	cos. 9.99824
			<hr/>
	Sum	.	cos. 9.82459
	Moon's declination,		
	$22^{\circ} 7'$	.	cos. 9.96681
			<hr/>
Its R.A. from Libra 0 =	$43^{\circ} 53'$		cos. 9.85778
R.A. Libra 0	= $180^{\circ} 0'$		
			<hr/>
Moon's R.A.	= $223^{\circ} 53'$		

*Note.*—If we take the arithmetical complement of the log. cos. of the declination and add it to the log. cos. of both the latitude and the longitudinal distance, we shall have the same result.

The R.A. of the other bodies is taken in the same manner, as they all happen to have some measure of latitude. Only when a body is in its node, and therefore coincident with the Ecliptic, does it have no latitude. In such case its R.A. is the same as that of the degree of the Ecliptic it holds.

We have next to find the meridian distances of the several bodies. To do this we have to find the R.A. of the Midheaven and Nadir, and take the nearest distance in R.A. of each body. Thus at noon on the 1st January 1916 the sidereal time is 18h. 39m. 16 secs. Convert this into degrees and minutes of the circle, thus : multiply the hours by 15 and call them degrees ; divide the minutes of time by 4 and call them degrees and minutes of space ; also divide the seconds of time by 4 and call them minutes and seconds of space.

$$\begin{array}{rcl} \text{Thus 18h.} & = & 270^{\circ} \ 0' \ 0'' \\ 39\text{m.} & = & 9^{\circ} \ 45' \ 0'' \\ 16\text{s.} & = & 0^{\circ} \ 4' \ 0'' \end{array}$$

$$\begin{array}{rcl} \text{R.A. of M.C.} & = & 279^{\circ} \ 49' \ 0'' \\ & & 180^{\circ} \ 0' \ 0'' \end{array}$$

$$\text{R.A. of I.C.} = 99^{\circ} \ 49' \ 0''$$

The upper meridian is called the Midheaven



(*medium cœli*) and the lower meridian is called the Nadir (*imaum cœli*).

Having the R.A. of the M.C. and I.C., we are able to find the quantity of R.A. which separates the various planets from them, and this is the meridian distance of each of such planets.

Thus the Sun's R.A. was found to be  $280^{\circ} 37'$ , and that of the M.C. (to which it is nearest) is  $279^{\circ} 49'$ . The difference is  $0^{\circ} 48'$ , which is therefore the meridian distance of the Sun.

The Moon is found to be in the South-west quarter of the heavens, and therefore nearer to the upper than the lower meridian. Its meridian distance must therefore be taken from this point. Thus :

R.A. of M.C.	$= 279^{\circ} 49'$
R.A., Moon	$= 223^{\circ} 53'$

---

Meridian distance of Moon =  $55^{\circ} 56'$

The other bodies are taken in the same way according to which meridian (upper or lower) they are nearest in R.A.

The semiarcs of the planets and luminaries have next to be found.

**Rule 3.**—To the log. tangent of the latitude of place for which the figure is set, or the horoscope cast, add the log. tangent of the planet's declination. The sum is the log. sine of the ascensional difference of that planet under the latitude of birth.

Uniformly, add this ascensional difference to  $90^\circ$  when the planet's R.A. is less than  $180^\circ$ , and subtract it from  $90^\circ$  if the planet's R.A. is more than  $180^\circ$ . The result is the diurnal semiarc of that planet. By subtracting this from  $180^\circ$  you will have the nocturnal semiarc.

Finally, by taking the meridian distance of the planet from its semiarc (diurnal if above the horizon, and nocturnal if below), you will have the horizontal arc, or distance in R.A. from the horizon.

Next find the proportional logarithm of the semiarc of each body, and take its arithmetical complement. Add to this A.C. the proportional logarithm of the planet's meridian distance. This is the constant log. of the planet for purposes of directing.

Enter all these elements into a single table, which is called the Speculum, an example of which will be found in the following pages. The scheme will now be ready for the practice of directing.

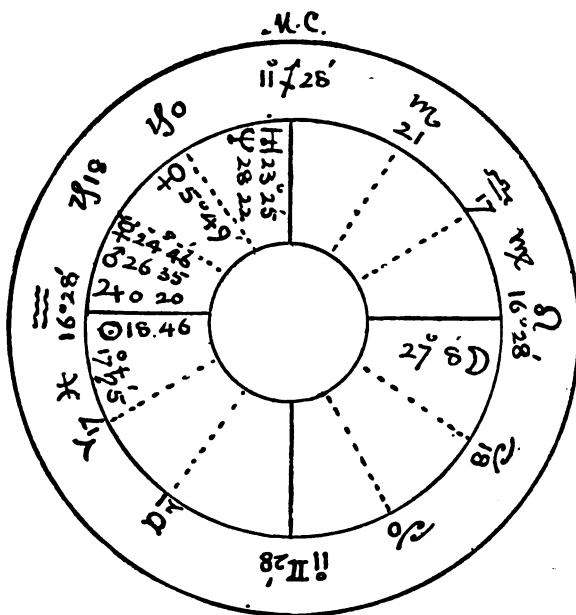
## CHAPTER II

### EXAMPLE HOROSCOPE

FOR the purpose of illustrating the method of directing by proportional semiarc, I have selected the horoscope of John Ruskin, whose *Fors Clavigera*, *Mornings in Florence*, and other world-renowned works have stamped him indelibly as artist and man of letters as well as an independent thinker of considerable virility.

He was born at 7.30 in the morning of 8th February 1819, in London.

It is an invariable rule in practice to use that semiarc and meridian distance which are related to one another. Thus the Sun in the speculum is just below the east horizon at the moment of birth, as may be seen by comparing its nocturnal semiarc with its distance from the lower meridian, which are  $110^{\circ} 1'$  and  $108^{\circ} 44'$  respectively. This shows the Sun to be  $1^{\circ} 17'$  below the horizon. But as by the diurnal rotation of the earth on its axis from west to east the Sun will be carried above the east horizon upwards towards the Midheaven, during the course of which it will pass the places



SPECULUM.

Planets.	Lat.	Declin.	R.A.	Merid. Dist.	Semi-arc.	Hor. Arc.
Sun . . .	° —	15° 13' S.	321° 12'	108° 44'	110° 1'	1° 17'
Moon . . .	5 1 N.	25 39 N.	120 17	50 21	52 51	2 30
Mercury . . .	0 23 S.	21 34 S.	296 47	46 51	60 11	13 20
Venus . . .	5 10 N.	18 10 S.	276 6	26 10	65 37	39 27
Mars . . .	0 55 S.	21 45 S.	299 6	49 10	59 53	10 43
Jupiter . . .	0 21 S.	20 26 S.	302 37	52 41	62 3	9 22
Saturn . . .	1 56 S.	6 54 S.	348 54	81 2	98 45	17 43
Uranus . . .	0 6 S.	23 24 S.	262 49	12 53	57 1	44 8
Neptune . . .	1 13 N.	22 14 S.	267 47	17 51	59 5	41 14

of Mars, Mercury, Venus, Neptune, and Uranus, it will be convenient also to have the semidiurnal arc and the meridian distance from the Midheaven. For whenever we use the nocturnal arc we always use the corresponding meridian distance from the lower meridian, and whenever we use the diurnal arc we also use the corresponding meridian distance from the Midheaven or upper meridian. This point should not be forgotten. It cannot be overlooked if the constant log. of the planet is inserted in the speculum, because this embodies the proportion of the semiarc to the corresponding meridian distance.

Ruskin was agreeably disposed towards the idea of planetary influence in human life, for, although he confessed entire ignorance of the subject himself, he was always willing that others should have the full benefit of his experience and views, and he readily gave his birth data to those who sought it for the purpose of astrological calculations. His assertion that "there is more in it than is generally supposed" was doubtless the opinion he formed of the science from experience; and if it does not carry the weight of scientific criticism, it stamps Ruskin, at all events, as a man of fearless integrity of thought.

In this horoscope we have a remarkable illustration of the principles of astrology. The Sun and Jupiter are rising in the humane sign Aquarius, while most of the planets are rising and above the

horizon. These are indications of success and distinction in the world. The conjunction of Mars and Mercury in opposition to the Moon indicated that asperity and outspokenness which characterised this man of genius and rendered him fearless in the expression of his views. His eccentricities may well be attributed to the meridian position of Uranus and Neptune, while Venus, in closest aspect to Jupiter, and well elevated, disposed to success in the pursuit of art, of which he became a foremost exponent. But, of course, these positions do not make character. They only afford the opportunity for its full expression. Character and environment together constitute destiny, and it is undoubtedly often the case that one or the other of them is a misfit. It is only when we get a strong innate character with appropriate celestial environment that we look for the expression of genius.

We may now proceed to use this horoscope to illustrate the principles of directing.

Take first the Midheaven. This is directed by right ascension, and the planets coming to the meridian will form arcs of direction to it. The aspects to Midheaven should be noted. Thus the semisquare aspect falls in Capricorn  $26^{\circ} 28'$ , and the sextile aspect is Aquarius  $11^{\circ} 28'$ , and planets coming to these points will form aspects in the zodiac to the Midheaven. The square aspect falls in Pisces  $11^{\circ} 28'$ ; and as Saturn is lower in the heavens than that point, it must come up to the

place of this aspect and form the zodiacal square to the Midheaven. And the times in which these aspects are formed by the several planets will be in the proportion of their semiarcs. These directions are in zodiac.

The other kind of direction is in mundo—that is, in the circle of observation or prime vertical. Thus a body that is on the cusp of the twelfth house is in mundane sextile to the Midheaven or upper meridian, and one that is on the cusp of the eleventh house is in mundane sextile to the horizon or Ascendant. A planet that is in the middle of the eleventh house will be half way between the Midheaven and Ascendant, and, therefore, in semisquare aspect in mundo, because the meridian and horizon are always at right angles to one another. If a planet is not thus situated at the moment of birth it will afterwards attain that position, and the number of equatorial degrees which pass under the meridian from birth to the time when the aspect is formed will be the measure of the arc of direction. The original position of a body, either in the zodiac or in mundo, is always that to which direction is made.

*Mundane Directions* are those that are made to the apparent place of a celestial body, or to its aspects, in the circle of observation.

*Zodiacal Directions* are those which are made to the geocentric longitude of a body, or to aspects of that longitude, in the circle of observation or prime vertical.

All directions are formed by the rotation of the Earth upon its axis from west to east, by which the planets appear to rise, culminate, and set, pursuing a course that is from east to west. The lines or arcs traversed by the planets in this apparent motion are parallels of latitude of the same quantity and denomination as geographical parallels of latitude—that is, lines parallel to the Equator. The planets follow the parallel of declination in which they are found at the time of birth.

It is understood that the radical imprint of a planet is localised in that part of the heavens it occupied at the moment of birth; and although the actual planets do thereafter change their declinations and semiarcs, as well as their meridian distances, the radical imprint of the planet remains ever the same, and is to be regarded as entirely distinct from the planet itself, which, of course, moves along its arc in the heavens.

In the process of directing we are, therefore, only concerned with the radix or root horoscope and the changes which thereafter take place in the heavens, not among the bodies themselves, but in their relations to the radix. All directions of this nature are formed within a few hours of the moment of birth.

Directions (whether in the zodiac or mundo) are of two orders. These are “direct” and “converse.”

Direct directions are such as are formed by one



body being carried by the motion of the Earth towards another body or aspect in the heavens that precedes it. Converse directions, however, are such as are formed in the opposite direction. Thus in the foregoing horoscope of Ruskin, if we bring the Sun to the place of Jupiter, or Mars, or Mercury, or Venus, these would be direct directions, because that is the direct motion of the bodies in the heavens. But if we brought the Sun to the place of Saturn it would appear that we are carrying it backwards to a position that it held previous to the moment of birth. This, however, is not the case. The Sun is joined to the Earth by a direct ray which is called its earth-line, and it is this line which, by the rotation of the Earth on its axis, is carried down (bearing the solar imprint) to the place held by Saturn at the birth. This is a converse direction. But if we bring Saturn up to the place of the Sun it would be a direct direction.

Therefore all directions are formed by the one natural fact of the Earth's rotation on its axis, and aspects that cannot thus be formed are not within the category of primary directions.

We may now pass on to illustrate the method of forming every kind of direction, direct and converse, in zodiac and mundo.

## CHAPTER III

### DIRECTIONS IN MUNDO

THE principle involved in this process is that which enters into the construction of the horoscope, wherein we take one-third of the Sun's tropical semiarc as the extent of the house or division of the prime vertical. This principle enters into the construction of the tables of houses for various latitudes, the Sun's extreme declination remaining a constant quantity.

But in every horoscope we have the various planets with different declinations, and therefore with different semiarcs; and consequently we are dealing with arcs which, although parallel to the Equator and to one another, are not parallel to the circle of observation. Hence an equal division of the prime vertical into twelve parts or houses will not effect an equal division of the various planetary semiarcs, which cut the meridian and horizon at varying angles depending on their declinations. Nevertheless, it has been found in practice that one-third of the semiarc, great or small, is equal to a house-space under the pole of that planet.

Suppose a planet to be exactly rising at the time of birth. Let its semidiurnal arc be  $66^{\circ} 21'$ . This is an arc of right ascension. Therefore when it has traversed one-third of its arc from the horizon to the meridian,  $22^{\circ} 7'$  will have passed under the meridian, and that will be the arc of the planet's direction to the cusp of the twelfth house. Another  $22^{\circ} 7'$  will bring it to the cusp of the eleventh house, and yet another arc of the same value will bring it to the meridian. When on the cusp of the twelfth house it will be in sextile aspect to the Midheaven, and when on the cusp of the eleventh it will be in sextile to the Ascendant, both directions being *in mundo*, as distinguished from similar aspects in the zodiac.

If the Sun or Moon happen to be exactly on the cusp of a house, then the planet coming to the cusp by one-third divisions of its semiarc will simultaneously form aspects in mundo to the Sun or Moon. But if they are not so placed, then we have to find their proportional distances from the nearest cusp or limit of a house, and bring the planet to the same proportional distance in order to form the aspect.

*Rule.*—To find the cuspal distance of a planet. Note the cusp to which it is nearest at the time of birth. The distance of that cusp from the horizon compared with the planet's horizontal arc will give the planet's cuspal distance.

*Example.*—In the specimen figure the Sun is

nearest to the cusp of the first house or ascendant, and therefore its horizontal arc,  $1^{\circ} 17'$ , will be its cuspal distance. The Moon has a semiarc of  $52^{\circ} 51'$ , and its horizontal arc is  $2^{\circ} 30'$ , and as this is nearest to the cusp of the seventh house, that will also be its cuspal distance.

Now, as in all directions, the body to which direction is made is considered to remain stationary while the body directed is moved towards it by its natural motion in the heavens, we here direct the Moon to the sesquiquadrate aspect of the Sun, which it attains in the middle of the fifth house, that point being four and a half houses, or  $135^{\circ}$ , from the ascendant. The Sun, however, is not on the ascendant, and therefore we have to bring the Moon to a proportional distance from the middle of the fifth house. Thus :

As the semiarc of the Sun, $110^{\circ} 1'$ ,	
prop. log. . . . .	0·21381
	<hr/>
arith. comp. . . . .	9·78619
Is to its cuspal distance, $1^{\circ} 17'$ , .	2·14693
So is the semiarc of Moon, $52^{\circ} 51'$ , .	0·53223
	<hr/>
To its proportional distance, $0^{\circ} 37'$ ,	
prop. log. . . . .	2·46535

Now, as one-third of the Moon's semiarc is  $17^{\circ} 37'$ , that will be its house-space, and one-half will be  $8^{\circ} 48\frac{1}{2}'$ , making for one and a half houses  $26^{\circ} 25\frac{1}{2}'$ , and from this we subtract the above proportional

distance, namely  $0^{\circ} 37'$ , and there remains the arc of direction : Moon,  $135^{\circ}$ , Sun in mundo,  $25^{\circ} 48\frac{1}{2}'$ .

Another example : Bring the Sun in the example horoscope to the mundane conjunction with Jupiter.

In order to effect this the Sun has to cross the horizon, its distance from which has been found to be  $1^{\circ} 17'$ . Thereafter we employ its diurnal arc and bring it to an equivalent distance from the horizon southwards as Jupiter is in the horoscope, by proportion of their semidiurnal arcs.

Jupiter's semiarc is  $62^{\circ} 3'$ , and its meridian distance  $52^{\circ} 41'$ , their difference  $9^{\circ} 22'$ , which is the horizontal arc of Jupiter and therefore its distance from the cusp of the first house. Then we say :—

As the semiarc Jupiter (arith. comp.) is to its cuspal distance, so is the semiarc of the Sun (diurnal =  $69^{\circ} 59'$ ) to its proportional distance from the same cusp southwards. This works out as follows :—

S.A. Jupiter,  $62^{\circ} 3'$  . . . . log. 0.46253

Arith. comp. 9.53747

Cusp. distance,  $9^{\circ} 22'$  . . . . 1.28369

S.A. Sun,  $69^{\circ} 59'$  . . . . 0.41028

Sun's prop. distance =  $10^{\circ} 34'$  log. 1.23144

Sun to horizon =  $1^{\circ} 17'$

Arc of direction =  $11^{\circ} 51'$

Sun conj. Jupiter *m.*

It should be observed that the arc of direction to the horizon must always be added when the planet or body has to cross the horizon in forming the direction. Here the proportion of the Sun's arc to that of Jupiter gives a cuspal distance of  $10^{\circ} 34'$ , and to this has to be added the distance of the Sun from below the horizon, making the arc altogether  $11^{\circ} 51'$ . When crossing the meridian to form a direction, no change of arc is necessary, but the arc to the meridian, which is the meridian distance of the planet, must be added to the arc formed on the other side of it.

It should be observed also that the body to which direction is made, and which is supposed to be stationary, supplies the first and second terms of the proportion, while that body which moves to form the direction supplies the third term and the resulting fourth term. In practice it will be found expedient to arrange all the mundane aspects in the order in which they are formed by each of the planets. The Midheaven and Ascendant remain stationary, and the Sun, Moon, and planets are the promissors that are moved to form directions upon them. Take one of these bodies at a time and make a list of the mundane directions it forms to the Midheaven, Ascendant, Sun, and Moon, calculate them, and arrange them afterwards in the order of their values. Always remember that the diurnal motion of the Earth upon its axis from west to east is the underlying cause of all

directions, and that the planet to which direction is made, remains still, while the other moves towards it. You cannot then go wrong in your application of the method.

Direction to the conjunction in mundo is effected by bringing the body of a planet to the body of another, and not to its zodiacal longitude merely, as is done in the case of the zodiacal conjunction.

Thus in the case of Uranus to conjunction M.C. in mundo, we take its meridian distance as the arc of direction, whereas in the zodiac we take the meridian distance of its longitude, Sagittarius  $23^{\circ} 25'$ , and this will be the arc of direction.

In all cases we bring the *body* of the planet directed to the conjunction or aspect of another body in mundo, to form mundane directions, all such directions being formed in the prime vertical, and expressed in terms of right ascension.

It will be found convenient to have the constant log. of the cuspal distance of each planet in the speculum. Subtract the proportional log. of the semiarc from the proportional log. of the cuspal distance. This will give the constant log., to which we have merely to add the proportional log. of the semiarc of any other planet to find the proportional cuspal distance of that planet.

It has been customary to regard the semiarc of a planet as equal to the quadrant, and therefore one-third as equal to a house or  $30^{\circ}$ . This is true in regard to a prime vertical whose pole is the

same as the declination of the planet, but it is not true in regard to any other pole or geographical latitude. That is why we take the proportion of the semiarc in finding the cuspal distances of planets. The test is this: If we take the oblique ascension of a planet, that is, exactly one-third of its semiarc from the horizon, it should have the same oblique ascension as the cusp of the twelfth house, but by adding 60 to the right ascension of the Mid-heaven to get the oblique ascension of that house, we shall find that if the planet has any other declination than  $23^{\circ} 27'$  there is a difference between the two results. It cannot, therefore, be truly said that a planet is in mundane sextile aspect to the Mid-heaven when it is one-third of its semiarc above the horizon, inasmuch as its position in the prime vertical does not then coincide with the cusp of the twelfth house; but it may be said to correspond with that cusp on the general proposition that all circles are equal to one another and therefore that all quadrants are equal, and in practice it is found that one-third of a semiarc corresponds with one-third of the prime vertical, and this was allowed by Placidus, who was the first exponent of this system of mundane directions.



## CHAPTER IV

### DIRECTIONS IN THE ZODIAC

THESE are calculated on the same principle as mundane directions, that is to say, by proportion of the semiarc; but instead of taking the actual body of the planet, or its position in the prime vertical, we take the longitude only and direct to that, and also to its aspects in the zodiac.

Thus in the horoscope of Ruskin the planet Neptune holds the longitude Sagittarius  $28^{\circ} 22'$ , and therefore its zodiacal sextiles will fall in Aquarius  $28^{\circ} 22'$  and Libra  $28^{\circ} 22'$ , its squares in Pisces  $28^{\circ} 22'$  and Virgo  $28^{\circ} 22'$ , and so on.

The longitude of the planet, or its aspect if we are directing to it, remains stationary, and the actual body of the planet or luminary which is directed to it is moved along its own semiarc until it reaches the longitude or aspect to which direction is made.

Therefore we take the meridian distance and semiarc of the ecliptic degree held by a planet and use these as the first and second terms of a proportion, in which the semiarc of the body directed forms the third term.

*Example.*—Direct the Sun to a conjunction with Jupiter in the zodiac.

Jupiter's longitude is Aquarius  $0^{\circ} 20'$ , and from the tables we find this longitude to have R.A.  $302^{\circ} 31'$ , from which take the R.A. of Midheaven,  $249^{\circ} 56'$ , and we get its meridian distance,  $52^{\circ} 35'$ .

The same tables give the ascensional difference under London as  $30^{\circ} 51'$ , which, taken from  $90^{\circ}$  as the declination is south, gives the diurnal semi-arc  $= 59^{\circ} 9'$ .

Prop. log. meridian dist.	. $52^{\circ} 35' = .53442$
„ semiarc	. $59^{\circ} 9' = .48332$
<hr/>	
Constant log. Aquarius	. $0^{\circ} 20' = .05110$
Prop. log. Sun's semiarc	. $69^{\circ} 59' = .41028$
<hr/>	
„ Sun's prop. dist.	$62^{\circ} 13' = .46138$
Take from Sun's merid. dist.	$71^{\circ} 16'$
<hr/>	
Arc of direction	. $9^{\circ} 3'$

The constant logarithm of a longitude, once obtained, should be reserved, as it will serve for all zodiacal directions made to the same point of the ecliptic by simply adding the log. semiarc of the body directed to it. We then have the proportional meridian distance, which, compared with its original distance, gives the arc of direction.

Uniformly, find the R.A. of the longitude to which direction is made; from this derive the meridian distance. Find its declination, and from

this derive the semiarc. Subtract the proportional logarithm of the semiarc from that of the meridian distance, and derive the constant log. of the given longitude. To this constant log. add the log. semiarc of the body directed to it, and thus obtain the proportional distance of that body from the meridian at the point of direction. The difference between this and its radical meridian distance is the arc of direction.

*Examples :—*

1. Direct the Sun to aspects of the Midheaven in the zodiac. The aspects to which the Sun applies are the sextile in Aquarius  $11^{\circ} 28'$ , the semisquare in Capricorn  $26^{\circ} 28'$ , and the conjunction in Sagittarius  $11^{\circ} 28'$ .

Aquarius  $11^{\circ} 28'$  has R.A.  $313^{\circ} 55'$

The Midheaven has R.A.  $249^{\circ} 56'$

---

Merid. dist. of aspect =  $63^{\circ} 59'$  prop. log.  $\cdot 44921$

Asc. diff.  $23^{\circ} 9'$

$90^{\circ} 0'$

---

Semiarc  $66^{\circ} 51'$

prop. log.  $\cdot 43017$

---

Constant log. of aspect in Aquarius  $11^{\circ} 28' = \cdot 01904$

Add prop. log. Sun's semiarc diurnal  $\cdot 41028$

---

Sun's prop. dist. from M.C.  $66^{\circ} 59'$   $\cdot 42932$

Radical dist. of Sun from M.C.  $71^{\circ} 16'$

---

Arc of direction, Sun sextile M.C. =  $4^{\circ} 17'$

2. The next aspect of the Sun to the Midheaven in zodiac falls in Capricorn  $26^{\circ} 28'$ , which is the semisquare aspect of  $45^{\circ}$ .

The R.A. of this longitude is  $298^{\circ} 29'$ , and its meridian distance is therefore  $298^{\circ} 29' - 249^{\circ} 56' = 48^{\circ} 33'$ . Its ascensional difference is  $28^{\circ} 40'$ , which gives its diurnal semiarc  $= 61^{\circ} 20'$ .

Proportional log.  $48^{\circ} 33' - \text{prop. log. } 61^{\circ} 20' = \text{constant log. of aspect, } .10150$

To this we add the

prop. log. of Sun

as before, namely,  $.41028$

---

$.51178 = 55^{\circ} 23'$  Sun's    propor.  
meridian dis-  
tance;

which take from

$71^{\circ} 16'$  Sun's    radical  
distance,

remains

---

$15^{\circ} 53'$  the arc of di-  
rection Sun  
semisq. Mid-  
heaven.

3. The next aspect of the Sun to Midheaven in zodiac is the conjunction. For this the calculation is simply the difference of their right ascensions.

That of the Sun is  $321^{\circ} 12'$

That of the M.C.  $249^{\circ} 56'$

---

Difference  $71^{\circ} 16' = \text{arc of direction.}$

These examples will doubtless serve for all cases that may arise in the course of directing a planet to the longitude and aspects of another in the zodiac.

We may now consider *converse* directions in the zodiac. These are calculated in exactly the same manner as the direct directions; but instead of moving the directed body forward in the heavens, that is, from the Nadir to the Ascendant, from the Ascendant to the Midheaven, from the Midheaven to the Occident, and so on, we move it conversely against the natural diurnal motion of the celestial bodies in the heavens. Thus, in the example horoscope the Moon is in Cancer  $27^{\circ} 8'$ . Therefore, to bring Saturn to the square aspect of the Moon in the zodiac, we have to bring it to Aries  $27^{\circ} 8'$  by converse motion. We therefore find the meridian distance and semiarc of that point in the ecliptic, the meridian distance being taken from the lower meridian, to which it is nearest, and the semiarc being the nocturnal arc. Find the constant log. due to this point of the zodiac, and add to it the log. of the nocturnal semiarc of Saturn. From this we derive the proportional distance of Saturn from the lower meridian, and the difference between this and its radical distance is the arc of direction.

Similarly, we bring the Sun down the eastern heavens to form the converse zodiacal conjunction with Saturn. Here we take the meridian distance of Pisces  $17^{\circ} 5'$ , and also its semiarc. Find the con-

stant log. due to these and add to it the log. of the nocturnal semiarc of the Sun. The sum will be the prop. log. of the Sun's meridian distance at the conjunction, and the difference between this and the radical distance of the Sun from the same meridian will be the arc of direction.

The bodies of Jupiter, Mars, Mercury, Venus, Neptune, and Uranus are brought to the zodiacal conjunction with the ascendant conversely by the measure of their horizontal arcs, which are derived by subtracting the meridian distance from the semiarc.

Thus Jupiter comes to the conjunction with the ascendant in zodiac conversely in an arc of  $9^{\circ} 21'$ , Mars in an arc of  $10^{\circ} 43'$ , Mercury in an arc of  $13^{\circ} 20'$ , Venus in an arc of  $39^{\circ} 27'$ , Neptune in an arc of  $41^{\circ} 14'$ ,<sup>1</sup> and Uranus in an arc of  $44^{\circ} 8'$ . Similarly, the Moon is brought to an opposition of the ascendant in zodiac by an arc of  $2^{\circ} 30'$ , which is the difference between its semiarc and meridian distance. This arc is much smaller than appears from its longitudinal position, and is due to the fact that the Moon has  $5^{\circ}$  of north latitude. A body with much north latitude sets much later and rises much sooner than does the degree of the ecliptic it holds. This is the radical difference between the mundane and zodiacal positions of a celestial body.

<sup>1</sup> An ephemeris of the approximate longitude and latitude of the planet Neptune from 1800 to 1900 A.D. is published by Messrs Foulsham & Co. Price 1s.

The Midheaven is directed to the conjunction with these planets in the zodiac by an arc equal to the difference of the R.A. of the Midheaven and that of the longitude of the planet.

Thus Venus comes to the Midheaven with the R.A. of Capricorn  $5^{\circ} 49'$ , which is  $276^{\circ} 25'$ , and the difference between this and the R.A. of the Midheaven  $249^{\circ} 56' = 26^{\circ} 29'$  arc of direction of Midheaven conjunction Venus in zodiac.

Uranus comes to the Midheaven in the zodiac by an arc of  $12^{\circ} 53'$ , Neptune by an arc of  $18^{\circ} 17'$ , Venus by an arc of  $26^{\circ} 29'$  (as above), Mercury by an arc of  $46^{\circ} 44'$ , Mars by an arc of  $48^{\circ} 41'$ , Jupiter by an arc of  $52^{\circ} 36'$ , and the Sun by an arc of  $71^{\circ} 16'$ . These arcs, it will be observed, differ from the meridian distances of the several bodies as given in the speculum by an increment which is due to the latitudes of the various bodies. The meridian distances in the speculum will be the same as the measure of their directions to conjunction with the Midheaven in mundo.

We may now pass to another series of directions.

## CHAPTER V

### ZODIACAL AND MUNDANE PARALLELS

IN astrology the parallel of declination is deemed of the same significance and value as the conjunction, but its effects are more lasting, and if formed near the tropics, Cancer 0 or Capricorn 0, they will last for years together and characterise a whole period of the life.

A *zodiacal* parallel is formed by directing a body to the place held by a zodiacal degree which has the same declination as that held by a planet to which direction is made.

*Example.*—The Sun at birth has  $15^{\circ} 13'$  of declination. On the principle that all parallels of declination, being at the same distance from the Equator, act magnetically in unison, any body coming to an ecliptic degree which holds the same declination as the Sun, namely,  $15^{\circ} 13'$ , whether north or south of the Equator, will act as if in conjunction with the Sun. Reference to the tables will show that there are four points which have this same declination, namely, Aquarius  $18^{\circ} 46'$ , Taurus  $11^{\circ} 15'$ , and Scorpio  $11^{\circ} 15'$ . Therefore, if we



## ZODIACAL AND MUNDANE PARALLELS 33

direct any body to any of these four longitudes in the zodiac by the rules given for directions in the zodiac, we shall bring them to parallels of the Sun in zodiac. The process is exactly the same as if we were directing to an aspect in the zodiac.

A *mundane* parallel is formed by the direction of a body to the same distance on one side of the meridian or horizon as that radically held by another body on the other side of the same meridian or horizon. These can be readily computed by reference to their horizontal arcs.

*Example.*—Bring Saturn to the mundane parallel of the Sun. The Sun's radical distance from the horizon northwards is determined by the difference of its meridian distance and semiarc, namely,  $110^{\circ} 1' - 108^{\circ} 44' = 1^{\circ} 17'$ , and we therefore have to bring Saturn to the same distance above the horizon. The semiarc of Saturn is  $98^{\circ} 45'$ , and its meridian distance  $81^{\circ} 2'$ ; its horizontal arc therefore is  $17^{\circ} 43'$ . Then say: As the semiarc Sun is to its horizontal distance, so is the semiarc Saturn to its proportional distance, which, being added to the first or radical distance of Saturn from the horizon, will give the arc of direction.

Some writers on this subject have repudiated the parallel in mundo formed upon the horizon, but without adequate reason being adduced in support of their objection. Yet the same writers have not denied the efficacy of parallels formed on the *same* side of the meridian, one south and the other

north, as in the 4th and 9th houses, or the 11th and 2nd, 10th and 3rd, etc., forgetting that bodies so placed are at equivalent distances from the horizon!

The rule for parallels is the same as for aspects. As the semiarc of the stationary body is to its meridian distance, so is the semiarc of the moving body to its proportional distance, which, taken from its primary distance, or added if it passes into another quadrant in forming the aspect, will give the arc of direction.

Thus we may bring Saturn to a parallel with the Moon in mundo. The Moon here is  $2^{\circ} 30'$  from the west horizon, and below it. If we bring Saturn along its own arc until it reaches a proportionate distance below the east horizon, we shall have a mundane parallel formed on the same side of the horizon, but on opposite sides of the meridian. We could work this problem by reference to the meridian distances of the two bodies from the Nadir, and the result would be the same.

It should be observed that the Sun and Moon are regarded as signifiers in the formation of mundane parallels by the other bodies, and the meridian and horizon therefore become sectors, upon which the parallels are formed.

Another form of the parallel in mundo is what is known as the *rapt parallel*. This is formed by the motion of the Earth on its axis, whereby the various bodies are carried from east to west at

their several relative distances from one another until they come to the same distance on either side of the meridian or horizon. In this case *both* bodies move in the prime vertical at a rate proportionate to their relative semiarc.

*Rule.*—As half the sum of their semiarc is to half the sum of their meridian or horizontal distances, so is the semiarc of the body applying to the angle, to its distance from that angle at the formation of the parallel. This distance taken from its radical distance from the same meridian or horizon will give the arc of direction.

What we are actually doing is to bring the meridian or horizon to the mid-distance between the Sun and a planet, or between the Moon and a planet. And these mid-distances are of the greatest significance, whether in the zodiac or in mundo. Here we are considering them only in mundo.

*Example.*—Bring the Moon and Saturn to a rapt parallel. This is formed on the lower meridian.

Semiarc, Moon (nocturnal)	52° 51'
„ Saturn „	98° 45'
	<hr/>
	2)151° 36'
	<hr/>
Half sum of semiarc	. 75° 48' prop. log. 37560
	<hr/>
	Arith. comp. 9-62439

		Arith. comp.	9·62439
Merid. dist. of Moon	.	50° 21'	
„ „ Saturn	.	81° 2'	
		<hr/>	
		2)131° 23'	
		<hr/>	
		65° 41'	prop. log. 43782
Semiarc, Moon . . .	.	52° 51'	„ 53223
		<hr/>	
Proportional dist., Moon	.	45° 48'	„ ·59444
Radical distance	.	50° 21'	
		<hr/>	
Moon rapt. par., Saturn	=	4° 33'	arc of direction.

*Note.*—In all cases where the Midheaven (meridian) and Ascendant (horizon) are employed as sectors, the Sun and Moon are employed as signifiers. They form aspects by their own apparent motions in the prime vertical, and the planets form aspects to the radical of the Sun and Moon by the same motion. This is the underlying principle of all parallels in mundo, and all rapt parallels. Remember that in mundane directions you are always dealing with the bodies themselves and not their longitudes.

## CHAPTER VI

### ORDER OF DIRECTING

THE student will do well to employ some definite method of noting the various directions, and of collating and tabulating his results, otherwise he is sure to overlook some that are important when considered in association with others that attend them, whether they be of the same or a contrary nature. Thus, if in a train or sequence of evil directions there should occur a good aspect of Jupiter to the Sun or Moon, the health and fortunes will be greatly sustained thereby, so that what would otherwise appear a fatal set of arcs, in the presence of this benefic arc of direction would lose that extreme significance, and, although sickness might supervene, the good direction would indicate a favourable crisis.

The following method is therefore suggested as inclusive of all legitimate directions.

#### 1. *Mundane Directions*

(a) Direct all the bodies to aspects and conjunctions with the Ascendant from east to west and from west to east.

(b) Direct each of the bodies to all the aspects and the conjunction with the Midheaven, both ways.

(c) Direct the Sun to other bodies and their aspects in mundo, both ways.

(d) Direct the Moon to other bodies and their aspects in mundo, both ways.

(e) Direct each of the planets separately to mundane aspects and conjunctions with the Sun.

(f) Do the same in regard to the Moon.

(g) Direct the Sun to mundane parallels with the Moon and planets.

(h) Direct the Moon to mundane parallels with the Sun and planets.

(i) Direct the Sun to rapt parallels with the Moon and planets.

(j) Direct the Moon to rapt parallels with the Sun and planets.

## 2. *Zodiacal Directions*

Follow the same order as for mundane directions, omitting classes (g), (h), (i), and (j) (mundane and rapt parallels), which are not formed in the zodiac.

Note that in zodiacal directions a body is always moved to a longitude to form a conjunction or aspect, never the reverse of this. Also that the meridian and horizon are fixed circles which do not move in regard to any particular locality. The Midheaven and Ascendant are those points where

the ecliptic cuts through the meridian and horizon respectively.

All this long process of directing may appear to be very tedious. It certainly requires patience and method. But once done it lasts for a lifetime, which is a point to be considered. In possession of such a chart one may direct one's course with wisdom and success, avoiding those dangerous shoals, sandbanks, and breakers which occur in the course of every life—or, if it be beyond the power of a man so to do, he can at all events divest evils of much of their power over him by adjusting himself to them, making provision against times of evil fortune and doubling his efforts when times of prosperity are shown. Thus may a man order his going and bring his life to a peaceful end. Sudden death cannot overtake the man who has knowledge of the time of that event years in advance; and the keen edge of many afflictions, to which an all-wise Providence may dispose us for the greater ends of life, are dulled by a philosophic anticipation, so that, cutting less deeply, they leave the vital soul of man unhurt. Therefore, rather than pray that what is foreordained by the laws of life to the inscrutable ends thereof may be averted, let us rather pray with the Psalmist: "Teach me the number of my days, that I may apply my heart to wisdom."

## CHAPTER VII

### EFFECTS OF DIRECTIONS

IN order to complete this section of the work, which deals with that system of direction by semiarcs currently practised and approved, it will be necessary here to indicate the general effects of directions, so that the nature and import of events may be known as certainly as the time at which they are likely to transpire. I am here speaking of "effects" of directions as if these latter had a direct dynamic result upon the character and actions of an individual. I am disposed to classify astrologers in three main groups—fatalists, casuists, and idealists—according to the various views they take of the nature and purport of astrology. The Fatalists believe, or profess to believe, that there is a planetary configuration and an event which attends it. They admit no possible intervention, amelioration, or extenuation. *Che sarà sarà*, and that is the end of the matter. They argue a certain necessity of connection between character and environment as we find it and planetary positions at the moment of birth. As regards "directions," all of which



are formed within a few hours of the birth, they speak of them as "seeds sown" in the plastic soil of the human soul which spring up and bear fruit at the appointed time, as measured by the arc of direction. They are born when they are born by necessity of universal law, and they die when they die because fatal arcs of direction are then in force.

They speak of laws of Nature as if they were dynamic forces against which mankind cannot possibly contend. They forget that laws are only mental concepts induced upon our minds by an apprehension of the correlated successiveness of events, and that what we know about natural laws is an infinitesimal part of the possibly knowable. They speak of the bodies of this microscopic solar system of ours as if they were the be-all and end-all of existence. They forget that the continuity of matter is a fact only on the material plane, and that there are forces of an immaterial nature which transcend both matter and what we call the laws of material existence. The moral law is an illustration of this. It is spiritual in its origin and spiritual in its effects. If astrology teaches fatalism, its use is at an end and it becomes a suicidal science, since there is no object in knowing that which must inevitably take place. It would reduce man to an automaton and divest him of all moral responsibility.

The Casuists are those astrologers who accommo-

date their facts and figures to popular concepts by a discreet use of a *mélange* of spurious philosophy. They forever quote the effete adage: "The wise man rules his stars, the fool obeys them"; and that other which says: "The stars incline but do not compel." They put a premium upon the wisdom of experience and the will-power of a purposeful character, and promptly consign a man to destruction by telling him that his horoscope indicates he has neither one nor the other. They do not suggest to him that astrology, properly conceived and applied, is in itself the very concrete of experience, nor that the will-to-be and the will-to-do are functions of the human soul which rise superior to all circumstance, outlasting life itself.

The Idealists are those among astrologers who regard the intelligible universe as the expression of a Supreme Intelligence, who regard the planetary combinations merely as symbols, knowing that the causes of all effects are within man himself, the cogniser of all experience. They regard the "signs of the times" as the driver of a locomotive regards the signals, not as "causes" of disaster, but as warnings against it, an open book to those who can read the signals, but of no value to those who cannot. They look upon the science of astrology as a wireless operator looks upon his code-book, merely as a means of interpreting the signals—a science evolved by man for the service of man.

My own view of the matter is that there is some-

thing to say for the materialist side of the question, and a great deal more for the idealistic. There is not the shadow of doubt in my own mind as to the material fact of the interaction of the planetary bodies, nor as to the fact that this interaction is registered by an intervening body of the system only at certain angles. The Platonic dictum that "God geometrises" is nowhere better illustrated than in the law governing the interaction of bodies belonging to the same system. The physical effects of the syzygies, and especially of ecliptic conjunctions of the luminaries, are immediately appreciable. The law of the tides is a concrete example of the fact of interplanetary action. We cannot deny the dynamic effects of planetary action on the material plane, and we have every reason for including in this category the human organism, compounded as it is of cosmic elements and in direct physical relations with a material environment. But that does not warrant us in extending our views to include the action of physical bodies upon the immaterial part of us, the only part of us that is essential and distinctively human. The only thing that can directly affect the soul of man is the soul of another human being. There is continuity of action upon all planes of existence because there is a continuity of matter upon all planes, but we have no grounds for extending the range of action from one plane to another plane, except it be by mediation or agency. Else we

could say that a good soul must be possessed of a sound body, a beautiful soul of a comely body, and that our moral principles are derived from what we eat and drink—instead of which, what we eat and drink depends on our moral principles. There is sound philosophy in the words of Tennyson when he says that "Soul to soul strikes through a finer element of its own." It is capable of acting mediately through the physical body or immediately through its own essential being. These views will doubtless alter our viewpoint in regard to much that hitherto has been regarded as fundamental to a belief in astrology. The effort to accommodate the facts of astrology to the materialistic science of a generation ago has tended to this issue. Without in any way disposing of astrology as a physical science, it is high time that we learned to interpret the facts of that science in the light of the higher spiritual teaching to which we have access. Otherwise we shall debase the science and enslave our own souls. In such case it were better that our astrology had never been written. As a physical science, astrology has an immense future before it in this utilitarian age upon which we have embarked; but as a fatalistic creed it is not worth an hour's study.

These remarks will enable the reader to understand why, in the following statement of the "Effects of Directions," I have pursued the common practice of attributing certain results or

sets of conditions as accompanying the formation of "directions" or planetary combinations in the horoscope subsequent to the birth. They should not be regarded as inevitable "effects" of such directions, but rather as things signalled, as if we should hoist the red light to indicate "danger ahead," the green light for "caution," and the white light for "road clear." These signals do not cause disasters, but our ignorance of them, our inability to see them, or our wilful disregard of them may very well result in a catastrophe. Human science has harnessed many of the subtle and intangible forces of Nature and deployed them to the service of man. It may do the same with cosmic forces that are as universal as etheric action.

### *The Midheaven*

This point of the horoscope stands for dignity, influence, authority, and position, the worldly honour and credit of the subject, and for all that is associated with his social and communal status. Good directions, such as the sextile and trine of all planets, and the conjunction and parallel of Jupiter, Venus (and Mercury when well aspected at birth), are indications of an enhanced position, higher honours, social distinctions, increase of prestige, etc.

Evil directions, such as the semisquare, square, and opposition of all planets (including the Sun and Moon in this category), and the conjunctions

and parallels of Uranus, Neptune, Saturn, and Mars, indicate assaults upon the good name and credit of the subject, hurt to the business affairs, loss of position, rivalries, and unprofitable associations.

### *The Ascendant*

This point of the horoscope indicates things personal to the subject, as health, general welfare, comfort, environment, changes, and the common relationships of life, that which affects him through collective influence, the public state of affairs, etc.

Good aspects (as above enumerated) tend to benefit the subject by a variety of means differing as the nature of the planet which is in aspect by direction.

Evil aspects signal bad health, obstacles, hindrances, incommodities, troubles and annoyances of various kinds, according to the nature and position of the planet directed.

### *The Sun,*

when in a hylegliacal place (as defined by Ptolemy), has significance of the vital constitution and life of the subject. Generally it stands for the father and male representatives of a family, and for the honour, credit, and position of the subject himself. It is thus associated more particularly with the Midheaven.

*The Moon*

denotes the health, changes of fortune, the mother and female representatives of the family, the functional powers of the body, and, in its association with the Ascendant, public bodies, the populace, and public concerns generally.

If in a hylegliacal position, it indicates the vital organs and life of the subject.

*Note.*—Ptolemy defines certain parts of the horoscope as being vested with a vital prerogative, wherein the Sun has precedence by day and the Moon by night. It is a moot point whether other bodies, being in such positions (in the absence of the luminaries), may not be vested with the same prerogative, and again, whether the Sun or Moon, not radically in such a position, may become invested with such significance by coming to a hylegliacal place by direction after birth. Failing either the Sun or Moon, Ptolemy invests the Ascendant with the properties of hyleg or life-giver. But, whatever may be concluded in this debatable matter, it is certain that the Ascendant is most generally affected by evil directions at the time of a physical crisis, the afflicting planet generally indicating the nature of its cause.

The above points in the horoscope, the Mid-heaven, Ascendant, Sun, and Moon, are the signifiers, because they signify such persons and things in the life of the subject as are capable

of being affected by the conflict of human circumstance.

All directions are made either (*a*) by the natural motion of the significators to the places and aspects of the planets, or (*b*) by the natural motions of the planets to the places and aspects of the significators.

The triangle (trine) and parts of it are good aspects, and indicate some advantage according to the position and nature of the planet directed. The cross (square) and parts of the square are evil aspects, and indicate similar disadvantages.



## CHAPTER VIII

### PLANETARY INDICATORS AND THE MEASURE OF TIME

THE following definitions of planetary indications are necessarily only partial and incomplete, but they will serve doubtless to convey a more or less definite idea of the nature of events which may be expected to attend directions formed by them with the various significators.

It should be observed that the house which a planet directed to holds in the horoscope of birth, or that which a planet which is directed arrives at when the aspect is complete, has chief significance in regard to the department of life in which the events will transpire, the nature of those events depending primarily on (a) the nature of the aspect and (b) the nature of the planet involved.

In this light, therefore, it may be said that *Neptune* in good aspect indicates events of a beneficial nature connected with the use of the faculties or some special faculty, and frequently in connection with a form of art ; benefits from unexpected sources coming mysteriously to the subject ; unseen

and intangible influences at work for the benefit of the subject ; brilliant flashes and inspirations of the mind ; spiritual aid ; intuitive activity.

In evil aspect by direction it denotes chaotic and mysterious events adverse to the interests ; scandal, secret enmity ; undermining of the credit by misrepresentation and fraud ; treachery, ambush ; an involved state of affairs ; nervous leakage and depletion of energy ; wasting of tissue ; physical ennui and decline of the vital powers from inscrutable causes ; apprehension, fear, and dread of consequence ; danger of espionage ; loss by fraudulent concerns and false investments ; mental unrest and loss of faculty.

*Uranus* in good aspect denotes civic and governmental honours, preference, advancement ; unexpected benefits arising out of public concerns and affairs ; ingenuity, inventiveness ; originality ; success in mechanical and engineering business ; strokes of good fortune coming from unexpected sources ; new associations and alliances.

In evil aspect this planet denotes the breaking down of existing relationships, lesions and fractures, partings and separations, loss of a sudden and unlooked-for nature ; hurt by strikes and public demonstrations ; nervous lesion, paralysis ; breaks and dislocations.

*Saturn* in good aspect indicates favours from aged persons and benefits from old associations, long investments, time contracts, and a general

state of stability and steadiness in the fortunes, congenial retirement and sequestration.

In evil aspect Saturn depletes the vital powers, causes physical hurts by falls and contusions, morbid diseases, colds and chills, inhibition of bodily functions; loss of money and property; mental and nervous depression; privations, obstructions, hindrances, and general misfortunes. Saturn is anciently known as the Greater Infortune.

*Jupiter* in good aspect denotes increase of fortune, opening up of new and lucrative opportunities, expansion of interests, advancement, progress, honours, confidence, good judgment, a general feeling of expansion and well-being, both physical and mental.

In evil aspect Jupiter denotes losses, errors of judgment, vanity or excessive confidence, disfavour of legal men and clericals, physical disabilities arising from congestion and surfeit, excess or over-indulgence, "too much of a good thing," too much *confidence en soi*, and consequent loss of esteem with others. It indicates a period of low finance, due to lavish expenditure, severe losses, or heavy investments. Jupiter is anciently known as the Greater Benefic, but it is certain that its evil aspects denote anything but a beneficial state of affairs.

*Mars* in good aspect denotes activity, new enterprises, great output of energy with commensurate good results, travelling, the executive powers are stimulated, and much profitable work is done.

Benefits accrue from military men, business connected with iron, steel, and fire. The muscular system is strengthened and there is a disposition to increased activity. Honours due to deeds of daring and chivalry. Women frequently marry under this aspect.

In evil aspect Mars denotes hurts by burns, scalds, fire, and steel, with loss of blood, abrasions and cuts, and also fevers and inflammatory conditions of the body or that part of it indicated by the position of Mars by direction. Loss by fire or theft, sometimes attended by violence. Sudden alarms and disasters of various sorts. Mars was anciently known as the Lesser Infortune.

The *Sun* in good aspect indicates increase of prestige, honours and emoluments, new friends and associations of a creditable character, general advancement and good fortune.

In evil aspect the Sun denotes losses, disfavour of superiors, troubles through male members of the family, the chief, overseer, or manager of a business ; loss by governing bodies ; ill-health due to fevers. Reverses of various sorts according to the house in which the direction is completed.

*Venus* in good aspect signifies social and domestic success, pleasures and enjoyments, gifts and presents, decorations ; the young court or marry, and the mature have children born or daughters engaged or given in marriage, and such events happen as cause pleasure and satisfaction. The

affectional nature is stimulated and the health is good.

In evil aspect Venus denotes sorrows, disappointments, bereavements, grief, and losses, domestic and social troubles, and hurts associated with young women or children. Venus was anciently known as the Lesser Benefic, and the less one has of it when in evil aspect the better for all concerned.

*Mercury* acts in terms of the planet to which at birth it is in closest aspect ; but if not within orbs of an aspect with any planet, then in terms of the ruler of the sign it occupies. In good aspect it usually signifies activity, much occupation of a profitable nature, connected with writings, science, and business of a general nature. Travelling, profitable journeys, good news, gain in connection with the avocation or trade. An active time generally.

In evil aspect Mercury produces annoyances and disturbances, evil news, worry and anxiety, many short journeys to and fro to no purpose or profit, sleeplessness, irregular feeding, unrest.

The *Moon* in good aspect denotes pleasant and profitable changes, a change for the better in the general state of affairs, gain by public associations and concerns, favours from women of mature age, popularity.

In evil aspect it denotes loss by any of the above means, and a state of unrest both physical and mental which leads to neglect of duties and conse-

quent loss. Hurts from women. Some public affronts may be suffered. Changes are unfortunate, and best avoided.

### *The Measure of Time*

In the foregoing system of primary directions by proportion of the semiarc, the measure of time is  $1^{\circ}=1$  year, and every  $5'=1$  month.

Considerable discussion has been devoted to the question of time measurement in directions. Those who advocate the Arabian system of a day for a year have sought to bring primary directions into line with that system by equating arcs of direction made on the foregoing principle of semiarc, by adding the arc to the Sun's right ascension at birth, and then finding the day after birth at which the Sun attains this new right ascension. The count is made at the rate of one day for a year of life, and two hours for every month.

Others, again, have sought to apply a plus increment at the ratio of 365 to 360, seeing that the Sun moves through 360 degrees in 365 days, which is the same as taking the Sun's mean motion  $59' 8''$  as the value for  $1 \text{ day}=1 \text{ year}$ .

But it is obvious that none of these methods has any direct application to the system we are now concerned with, inasmuch as all the directions formed by the diurnal rotation of the Earth on its axis are formed within a few hours of birth so far as they apply to a life of ordinary length, and

they are measured in degrees of right ascension—that is to say, by the passage of the Equator under the local meridian in the prime vertical,—and therefore degrees of right ascension are the only uniform basis of measurement. It certainly does not seem consistent to measure arcs by one method and equate them in terms of another.

It should be observed, however, that primary directions in right ascension do not always coincide exactly with the events they are held to signify. Sometimes they are too short, and sometimes too long, but never more than a few minutes either way. Commander Morrison, R.N., was of opinion that the event signified was delayed or accelerated by reason of current transits in the horoscope at the time, and he further states that the chief effects may be expected to transpire when the lunar or secondary directions come into accord with them. This gives rather a wide margin of operation to the primary direction, and has led many to the conclusion that the secondary direction is, after all, the important one and deserving of primary consideration. A very little experience will show that it is not so, for, unless there are concurrent primaries in operation, lunar or secondary directions frequently pass with little or no result.

Primary directions and transits appear to answer to all the more important events in life.

At the same time we have to consider the *duration* of effects, and in regard to this it has been observed

that the process of formation of an arc of direction should be considered. For the longer a direction may be in forming, the longer will those events endure which it signifies. Here we have Fitzroy's old maxim again in evidence: "Long foretold, long last: short notice, soon past."

Thus an aspect to the Ascendant formed during the rising of a sign of short ascension such as Aquarius, Pisces, Aries, Taurus in northern latitudes, and the opposite signs to these in southern latitudes, will be speedily formed and over. On the other hand, a similar direction formed to the Ascendant when in a sign of long ascension will be formed more slowly, and will dissolve more slowly. In such case we might expect the signified event to begin to happen earlier and to end later than in the former case.

One finds in experience, however, that men frequently trace years of toil and suffering to a sudden disaster overtaking them in a moment. In my theory of transits, this could not happen in earlier years, but might easily occur at maturity when the accumulated results of a man's labour were heaped around him. (See Transits.)

The following illustrations will, however, sufficiently prove that there is adequate coincidence between arcs of direction and the events they are held to signify, to warrant the measure of time  $1^{\circ}=1$  year as scientifically valid.



## CHAPTER IX

### ILLUSTRATION

IN the example horoscope given in these pages we have a singularly interesting subject. The chief events of the life are well defined and closely indicated by the attendant arcs of direction. Hundreds of horoscopes, whether pertaining to individuals in high walks of life or of modest position in the world, could be adduced to show that this coincidence of direction and event is not fortuitous, but regular and consistent, and as dependable as any astronomical formulary. The student will find pleasure and instruction in working out the following arcs of direction in the present instance.

John Ruskin leapt into fame and became a "lion" in the world of art in the autumn of 1843 under the direction of

Sun sextile Midheaven mundo  $24^{\circ} 37'$

He was married on the 19th April 1848, and, while on his honeymoon, took a chill while sketching in Salisbury Cathedral and was seriously ill. This happened under the adverse directions—

Moon oppos. Venus mundo conv.  $29^{\circ} 16'$

Moon square Venus mundo dir.  $29^{\circ} 16'$

The nearness of these adverse arcs to the event of marriage proved unfortunate for such a domestic change. The danger of his choice of a wrong time and a wrong partner for marriage was radically indicated by the Moon's opposition to Mars and Mercury, and nothing but constant bickering could have been expected from such indications.

The first serious break in Ruskin's health was in May 1840, for which we have the direction—

Moon oppos. Saturn zod.  $21^{\circ} 46'$

He received honours from the University of Cambridge in May 1867 under the appropriate directions of

Ascendant trine Venus mundo  $48^{\circ} 2'$

Ascendant sextile Moon zod.  $48^{\circ} 22'$

He was elected Slade Professor of Fine Art on the 10th August 1869, and commenced his course of lectures under the following directions :

Ascendant trine Jupiter zod.  $50^{\circ} 35'$

Midheaven par. Jupiter zod.  $50^{\circ} 57'$

Ascendant par. Jupiter zod.  $51^{\circ} 14'$

Moon rapt par. Jupiter .  $51^{\circ} 22'$

In the following year his health gave way, and his mother died in December of that year, 1871. The arc for that year measured from  $51^{\circ} 53'$  to  $52^{\circ} 53'$ , and within these limits we have the significant directions—

Ascendant square Saturn zod. con.	51° 59'
Moon square Mars mundo . . .	52° 0'
Sun par. Uranus zod. con. . . .	52° 0'
Ascendant square Jupiter mundo .	52° 41'

followed by Moon par. Mars zod. 53° 3', close upon the death of his mother.

His health completely broke down again in 1888, under the directions—

Sun opposition Uranus zod. . . .	68° 49'
Sun opposition Uranus mundo . .	69° 14'
Moon rapt par. Saturn . . . . .	69° 30'

Here the Sun is hylegliacal, and, being so heavily afflicted from angles of the horoscope, and the Moon also afflicted by Saturn, only disastrous illness and misfortune could have been signified.

Nevertheless, he survived this affliction, and further added to his reputation as a man of letters and exponent of fine art during some ten years, until eventually, with declining vitality laying him open to attack, he was afflicted by influenza and succumbed on 20th January 1900, the arc for that date being 80° 57'. The following significant train of directions was then in force :

Sun par. Uranus zod. . . . .	80° 10'
Ascendant square Saturn mundo .	81° 2'
Ascendant sesquiq. Sun zod. . . .	81° 11'
Ascendant par. Uranus zod. . . .	81° 27'
Moon square Mars zod. con. . . .	81° 30'

In view of these directions, it cannot be said that we are not duly signalled by the celestial bodies, not only of the approach of evil times, when more than usual care and attention are due to health and fortunes, but also of those periods of good fortune when the sun smiles upon all our efforts and stimulates us to greater endeavours. The fault is altogether ours if we do not regard these portents. The beneficent Creator, having established these celestial bodies "for signs and for seasons," is ever faithful. He puts up the signals on every occasion. It is for us to apprehend and read them.

In King Edward VII.'s horoscope we have the attachment which led to his marriage indicated by

Venus conjunction Moon mundo .  $19^{\circ} 25'$   
 Moon conjunction Venus con. .  $20^{\circ} 7'$

The attempt on his life by the maniac Sipido, when as King he was travelling in Germany, measures to an arc of  $58^{\circ} 25'$ , and the appropriate direction was—

Sun opposition Neptune zod.  $58^{\circ} 21'$

The death of the Empress Frederick (Princess Royal) in August 1901 was indicated by the direction—

Midheaven conjunction Saturn  $59^{\circ} 43'$

The death of his royal mother, Queen Victoria,

requires an arc of  $59^{\circ} 14'$ , and we find the appropriate directions—

Midheaven square Moon zod.	. $58^{\circ} 58'$
Ascendant opposition Moon .	. $59^{\circ} 19'$
Saturn semisq. Ascendant .	. $59^{\circ} 22'$
Midheaven conjunction Saturn zod.	$59^{\circ} 42'$

These illustrations will doubtless serve for all practical purposes, and they can be worked out at leisure by those who wish to exercise themselves in this art.

Other methods than that here illustrated must claim our attention, inasmuch as they have consistently been advocated by various authors. There are, moreover, several points which may be considered as debateable, and these also have to be considered before our work is rendered complete. We must therefore pass on.

## CHAPTER X

### PTOLEMY AND PLACIDUS

It is generally conceded that the system of directing which has so far occupied our attention first originated as a measure of time in the mind of Claudius Ptolemy, the famous geographer, mathematician and astronomer of Alexandria, who flourished in the second century of our era, and wrote a standard work on the subject of astrology called in the Greek *Tetrabiblos*, and in the Latin *Quadripartite*, being four books on the Influence of the Stars. He also wrote the *Syntaxis* and the *Almagest*, which, together with his work on astrology, have been translated into every language in Europe and into many Oriental languages also.

From the writings of Sir Isaac Newton we have evidence that there were many sources of information open to Ptolemy in the pursuit of astrological knowledge, and there is no reason to suppose that he did not avail himself of them fully, for none has ever suggested that astrology as a science was first promulgated by him. But it may certainly be

affirmed that Ptolemy gave to the Western world the first scientific exposition of the subject. There are two Latin editions of the work and one in Greek. The best translation that we have is the paraphrase of Proclus from the Greek text rendered into English with extensive commentary by J. M. Ashmand, and recently published as a supplement to *Coming Events*. Ashmand has followed the Elzevir text, dated 1635.

The name of Claudius Ptolemy will be revived wherever astronomy and astrology are studied. It is enough for the purpose of this sketch to note that he was born at Pelusium in Egypt, and became a brilliant disciple of the Alexandrian School. It appears that he was born about the year 80 A.D., flourished during the reigns of Adrian and Antoninus Pius, and died in the seventy-eighth year of his age.

Of Placidus de Titus, who first rendered a studied version of Ptolemy's work on astrology, we have very little information. It appears that he was known as Didacus Placidus, and was a native of Bologna, became a monk, and was appointed mathematician to the Archduke Leopold William of Austria. He wrote in the early part of the seventeenth century a work entitled the *Primum Mobile*, in which he gives a thorough digest of the teaching of Ptolemy. The best English translation is by Cooper. Placidus showed that Ptolemy recognised two sets of directions arising out of

two sets of planetary positions, one in the zodiac and the other in the world, i.e. in the prime vertical. To Placidus remains the credit of having elaborated that part of directional astrology which has regard to directions in mundo.

Ptolemy makes it clear in his chapter on the "Number of the Modes of Prorogation" (bk. iii., ch. xiv.) that "when the vital prerogative is vested in the Ascendant, the anareta or killing planet may be brought to it by oblique ascension; and if it be vested in the Midheaven or a body there situate, then direction is to be made by right ascension. If on the occidental horizon, the degrees of oblique descension are to be reckoned. But if not in either of these three places, but in some intermediate station, it should be observed that 'other times' will bring the succeeding place to the preceding one, and not the times of ascension or descension nor of meridian transit as already declared.

"For, if it be desired to calculate agreeably to nature, every process of calculation that can be adopted must be directed to the attainment of one object—that is to say, to ascertain in how many equatorial times the place of the succeeding body or degree will arrive at the position preoccupied at the birth by the preceding body or degree, and, as equatorial times transit equally both the horizon and the meridian, the places in question must be considered in regard to *their proportionate*



*distances from both these, each equatorial degree being taken to signify one year."*

Here Ptolemy makes it clear that he directs a body in the heavens to one that precedes it, or a body to a degree that precedes it, which direction is formed by the diurnal rotation of the Earth on its axis from west to east. He also makes it clear that he uses the proportionate distances of bodies from both the horizon and meridian as the basis of the calculation, and the arc of direction is the intervening degrees (equatorial) between them, at the rate of one equatorial degree for a year of life.

It is evident, therefore, that he takes a proportion of the semiarcs, or, as he calls them, "the horary times," of the planets involved. These arcs he describes as parallel to one another and to the Equator, but cutting the circle of the horizon at various degrees of obliquity.

Obviously, therefore, we have to take proportion of their semiarcs and meridian distances, exactly as we have been instructed in the foregoing exposition; and as these semiarcs are regulated by the latitude of the place of birth and the corresponding ascensional differences of the planets, the positions of the bodies will have respect to the prime vertical and will be their apparent places in the plane of that circle. But it is important to note that Ptolemy says nothing concerning converse directions, whether in mundo or in the zodiac.

That he recognises the mundane position of a body as distinguished from the apparent place of its "degree" of longitude is obvious from his mentioning both in the same sentence; and we distinguish ourselves between the mundane and zodiacal conjunctions only by reference to the body of the planet in the first instance and its longitude in the other case.

To Claudius Ptolemy, therefore, may rightly be accorded the honour of having set astrologers upon the right track with regard to the correct measure of time by reference to the equatorial degrees separating one body from another, or one body from the longitude or aspect of another, as seen from the place of birth.

There is little doubt, from the illustrations of his method that Ptolemy gives, that he uses the "ascensional" times in all cases due to the latitude of the place of birth; and this method serves very well not only for directions to the Ascendant and Descendant, but also for intermediate positions when the planets are in the same or different quarters and on the same side of the meridian, for then their arcs may be measured with great facility and approximate accuracy from the Tables of Houses alone.

### *Illustration*

1. Bring the Sun to the place of Mars in the horoscope of Ruskin.

	h.	m.
The sidereal time on the Midheaven		
when Mars' place rises is . . .	15	49
That when the Sun rises is . . .	16	44

---

Difference in R.A. on the Mid-		
heaven in S.T. . . . .	0	55

Divided by 4, this gives  $13^{\circ} 45'$  as the arc of direction.

The same arc of direction when exactly calculated by the semiarc method is  $13^{\circ} 49'$ .

2. Bring the Sun to the conjunction with Venus in zodiac.

	h.	m.
The S.T. at sunrise (as above) is . . .	16	44
That when Venus' place rises is . . .	14	35
Difference . . . . .	2	9

This gives an arc of  $32^{\circ} 15'$ .

3. Bring Saturn to the place of Sun in zodiac.

The declination of Saturn is  $6^{\circ} 54'$  S., and this answers to the longitude of Pisces,  $12^{\circ} 37'$ .

	h.	m.
S.T. on Midheaven when this point		
rises . . . . .	17	30
S.T. on Midheaven when Sun rises . . .	16	44
Difference . . . . .	0	46

This gives an arc of  $11^{\circ} 30'$ .

4. Bring the Moon to the opposition of Venus in zodiac.

The declination of the Moon is  $25^{\circ} 39'$ , which exceeds that of any degree of the zodiac owing to the Moon's extreme latitude north added to the declination of its longitude. But reference to the Tables of Ascensional Difference and Right Ascension will show that its oblique descension answers to the twelfth degree of the sign Leo, which is the same as the oblique ascension of Aquarius  $12^{\circ}$ . Then the arc between the place and Venus in zodiac and Aquarius  $12^{\circ}$  will be the arc of direction. Thus :

	h.	m.
S.T. on Midheaven when Venus long.		
rises . . . . .	14	35
S.T. on Midheaven when the 12th of		
Aquarius rises . . . . .	16	30
	<hr/>	
Difference . . . . .	1	55

This gives an arc of  $28^{\circ} 45'$ .

5. Bring the Sun to the opposition of Uranus in zodiac.

Take the opposite degree of the zodiac to that held by Uranus, and bring the Sun to it by oblique arc.

	h.	m.
S.T. when Gemini $23^{\circ} 25'$ rises . . . . .	21	21
S.T. when Sun rises . . . . .	16	44
	<hr/>	
Difference . . . . .	4	37

This gives an arc of  $69^{\circ} 15'$ .

6. Bring Sun to par. Uranus in zodiac direct.

The declination of Uranus is  $23^{\circ} 24'$ , which answers to that of Cancer  $4^{\circ}$ . Find the arc between this and the Sun.

	h.	m.
S.T. on Midheaven when Cancer $4^{\circ}$		
rises . . . . .	22	6
S.T. on Midheaven when Sun rises		
in Aquarius $18^{\circ} 45'$ . . . .	16	44
Difference . . . .	5	22

This gives an arc of  $80^{\circ} 30'$ .

These examples will serve to show that without recourse to the elaborations of a speculum or the use of proportional logarithms in the computation of proportional arcs, Ptolemy could, by the mere use of a table of ascensions under any latitude, find the time of an indicated event within an arc of  $30'$  and even less, which, having regard to the approximations which are frequently adduced as "arcs for the event" when both are accurately known, show that they would serve for all practical purposes. I most frequently calculate arcs of direction in this manner, bringing out the results to the nearest quarter of a degree, which measures to three months of time. Ptolemy had constructed such tables, as appears from his *Almagest*, and this is obviously the method he used. In other words, he recognised no other directions than those that could be calculated by the difference of the oblique ascensions of the planets and of their longitudes,

taking the oblique ascension of their opposite degrees when the arc was formed by descension of a body.

A table of oblique ascensions such as that published by Worsdale enables the calculation to be made with even closer exactness. It has only to be remembered that when we are directing the body of a planet to the body or longitude of another, the longitude corresponding to its declination must be dealt with, and not the longitude of the body itself, as the above examples will sufficiently indicate.

## CHAPTER XI

### DIRECTIONS UNDER POLES

THIS method has been much advocated, and especially by Mr R. C. Smith, the first of the almanac writers under the pen-name of "Raphael." It consists in directing a significator under its own pole instead of under the pole of the place for which the horoscope is cast.

#### *To find the Pole of a Planet*

Take its R.A., declination, and semiarc.

Then say :

As the semiarc is to  $90^{\circ}$ ,

So is its meridian distance

To the difference of its circle of position and  
the meridian.

And this difference, compared with its meridian distance, will give its ascensional difference under its own pole.

Then having this and also its declination, from the sine of its ascensional difference under

its own pole take the tangent of its declination, and the remainder will be the tangent of its pole.

*Example.*—In the horoscope of Ruskin find the pole of the Sun.

The R.A. of Sun is  $321^{\circ} 12'$ , the meridian distance (below)  $108^{\circ} 44'$ , the semiarc  $110^{\circ} 1'$ , and the declination  $15^{\circ} 13'$ .

Semiarc $110^{\circ} 1'$	.	.	prop. log.	0.21381
				<hr/>
		Arith. comp.	.	9.78619
Quadrant of $90^{\circ}$	.	.	.	0.30103
Meridian distance	.	$108^{\circ} 44'$		0.21891
				<hr/>
Difference	.	$88^{\circ} 57'$		0.30613
				<hr/>
Asc. diff. under pole		$19^{\circ} 47'$	log. sine	9.52951
Sun's declin.	.	$15^{\circ} 13'$	log. tang.	9.43458
				<hr/>
Pole of Sun	.	$=51^{\circ} 13'$	log. tang.	10.09493

It is thus seen that the pole is measured along the tangent by its distance from the meridian or nadir, according as the body may be above or below the Earth at the time. At the meridian the pole would be 0, and at the horizon it would be the same as the latitude. Here "pole" is the same as polar elevation. The difference  $88^{\circ} 57'$  indicates the place of the circle of position from the



plane of the meridian circle. Circles of position are small circles which are parallel to the great circle of the meridian and at right angles to the great circle of the horizon. They are like lateral circles of latitude in relation to which the meridian stands as equator and the Ascendant and Descendant as poles. Hence, if a planet be on the cusp of a house, it will have the same pole as that house.

Having calculated the poles of all the planets, and of the Sun and Moon, direction of one to another of them is thus made.

*Rule.*—Take the oblique ascension (or descension, as the case may be) of the promittor or body directed to under the pole of significator, and the difference of this from the oblique ascension (or descension) of the significator under the same pole is the arc of direction.

To find the oblique ascension of a body under the pole of another directed to it, to the log. tang. of its declination add the log. tang. of pole of the body directed, and the sum will be the log. sine of its ascensional difference under that pole. From this its oblique ascension can be found by referring it to its R.A. according to the rule (see “Definitions,” Chapter I.).

*Example.*—Direct the Sun in the example horoscope to the place of Venus in the zodiac.

The declination of Capricorn  $5^{\circ} 49'$  is  $23^{\circ} 20'$ . The Sun's pole is  $51^{\circ} 13'$ . Then—

Pole of Sun, $51^{\circ} 13'$ .	log. tang.	10.09493
Dec. Venus long. .	log. tang.	9.63484

---

Asc. diff. of aspect $32^{\circ} 28'$	log. sine	9.72977
R.A. of aspect . $276^{\circ} 20'$		

---

O.A. of aspect . $308^{\circ} 48'$	under pole of Sun.
O.A. of Sun . $340^{\circ} 59'$	under its own pole.

---

Diff. .  $32^{\circ} 11'$  = arc of direction.

Applying this method to the hint I have already given as to the use of tables of oblique ascension, or tables of houses for various latitudes, we can calculate this arc perfectly well with a table of the houses for latitude  $51^{\circ} 13'$ , which is the pole of the Sun. And we can calculate all the solar arcs by this means from the same table. Then if we find the pole of the Moon, and refer to the Table of Houses for equivalent latitude, we shall be able to take out all the directions of the Moon under its own pole. The directions of the Ascendant will, of course, be made under the pole of the place of birth, and those of the Midheaven by right ascension only. So that what appears at first a complex and exhaustive piece of work can readily be done by tables of houses, or tables of oblique ascension for various latitudes, in next to no time, as the saying is. And this, I think, may be adjudged the most popular contribution to the theory

and practice of primary directions that I have been able to make.

*Example.*—Direct the Sun under its own pole to the opposition of Uranus in the zodiac.

The Sun's pole is  $51^{\circ} 13'$ . Therefore take in hand the Tables of Houses or the Tables of Oblique Ascension for latitude  $51^{\circ} 13' N$ .

The opposition of Uranus falls in Gemini  $23^{\circ} 25'$ .

	h.	m.
S.T. on Midheaven when Gemini		
$23^{\circ} 25'$ rises . . .	21	21
S.T. when Sun's place rises . .	16	43
	<hr/>	
	4	38

This converted into arc of R.A. =  $69^{\circ} 30'$  = arc of direction.

*Example.*—Direct the Sun under its own pole to Venus in the zodiac. Pole of Sun =  $51^{\circ} 13'$ .

	h.	m.
S.T. on Midheaven with Sun		
rising . . . . .	16	43
S.T. on Midheaven with Capri-		
corn $5^{\circ} 49'$ rising . . . .	14	35
	<hr/>	
Arc of direction, Sun conj. Venus		
zodiac = difference . . . .	2	8

This is equivalent to  $32^{\circ} 0'$ .

By exact calculation we found it formerly to be  $32^{\circ} 11'$ . The difference is inconsiderable from the point of view of probable time of the event.

As to the merits and demerits of these divergent systems of directing, I leave my readers to decide for themselves. *Experientia docet*. I hold no brief for either system, my business being merely to represent and to simplify. This I think I may claim to have done.

The system of directing under the semiarc in the prime vertical is that which was followed by Ptolemy. The system of directing under the poles of the planets is of considerably more recent origin, and dates to the seventeenth century only. It consists, as will be seen, in directing in the circle of observation due to the pole of the significator or planet directed. The difference is that which one may note as between the tables of houses for one latitude and another. Nothing is simpler or more demonstrable. I leave it at that.

But in general practice it will be found that equally close results may be obtained by simple proportion and the use of the tables. Take the following hint for what it is worth. I am quite satisfied in my own mind that what we call primary directions seldom or never operate exactly to time, and if we correct the observed time of birth by one direction for an event we shall find that subsequent directions are not on schedule time. We have to allow a latitude for the operation of these directions. Such being the case, and, in the experience of the best artists, the import of primary directions being accelerated or retarded by the

secondary directions and transits, we do not need to observe scruples. Approximations are always valuable.

The following may be regarded as the *via lætitia* in primary directing :—

*Rule 1.*—As the semiarc of the planet whose pole is required is to  $90^\circ$  of the prime vertical, so is the distance of the body in right ascension from the meridian (upper or lower as the case may be) to its proportional distance in the prime vertical.

*Rule 2.*—From the sine of their difference subtract the tangent of the planet's declination. The remainder is the tangent of its pole.

*Rule 3.*—For all directions under the pole of that planet or significator use the Tables of Houses for that latitude which answers to its pole.

*Rule 4.*—Find the difference between the ascension of the body (by sidereal time or right ascension on the Midheaven) and that of the planet directed to. This will be the arc of direction.

*Note.*—If the planets involved or the positions involved are between the tenth and fourth westward, take the ascensional degrees of the opposite places.

*Rule 5.*—Direct the Midheaven by right ascension only, and the Ascendant by oblique ascension under the latitude of birth. Direct the Sun under its own pole and the Moon under its own pole. This completes the entire scheme of primary directing.

*Example.*—In the horoscope of Ruskin the Sun

was found to have a pole equal to the latitude of  $51^{\circ} 13'$  N. (see p. 72). It must therefore be directed under the Ascendant of  $51^{\circ} 13'$ . Similarly, the Moon, whose pole is  $47^{\circ} 27'$ , must be directed under the latitude of that degree. A significator on the Midheaven would thus be directed by right ascension only, as stated by Ptolemy (see p. 64).

For directions of the Sun to other bodies, therefore, we use the Tables of Houses for  $51^{\circ} 13'$ . Those for Taunton are  $51^{\circ} 1'$ , which is deemed near enough.

1. Direct the Sun to Jupiter in the horoscope.

	h.	m.
S.T. on Midheaven with Sun rising	16	41
S.T. on Midheaven with Jupiter's long.		
rising . . . . .	15	55
<hr/>		
Arc of direction = $11^{\circ} 30'$ , equi-		
valent to S.T. . . . .	0	46

2. Direct the Sun to Mars.

	h.	m.
Sun rising as before, S.T. on Midheaven	16	41
Mars rising, S.T. on Midheaven . . . . .	15	43
<hr/>		
Arc of direction = $14^{\circ} 30'$ . . . . .	0	58

3. Direct the Sun to Mercury in zodiac.

	h.	m.
Sun's rising as before . . . . .	16	41
Mercury's longitude rising . . . . .	15	39
<hr/>		
Arc of direction = $50^{\circ} 30'$ . . . . .	1	2

## 4. Direct the Sun to Venus' longitude.

			h.	m.
Sun's rising as above	.	.	16	41
Place of Venus rising	.	.	14	30
<hr/>				
Arc of direction = $32^{\circ} 45'$	.	.	2	11

## 5. Direct the Sun to Neptune in zodiac.

			h.	m.
Sun's rising as before	.	.	16	41
Neptune's long. rising	.	.	13	59
<hr/>				
Arc of direction = $40^{\circ} 30'$	.	.	2	42

## 6. Direct the Sun to Uranus in zodiac.

			h.	m.
Sun's rising as above	.	.	16	41
Uranus' long. rising	.	.	13	36
<hr/>				
Arc of direction = $46^{\circ} 15'$	.	.	3	5

## 7. Direct the Sun to opposition of Moon in zodiac.

			h.	m.
Sun's rising as before	.	.	16	41
Rising of Capricorn $27^{\circ} 8'$ , S.T.	.	.	15	47
<hr/>				
Arc of direction = $13^{\circ} 30'$	.	.	0	54

The various aspects to these promittors can be picked up *en route* as we bring the Sun from the horizon to the Midheaven, which it reaches in an arc of  $69^{\circ} 59' = 70$  years nearly.

We cannot direct Sun to Saturn by the diurnal motion of the Earth, and so we must bring Saturn

up to the Sun's place. This involves knowing the pole of Saturn.

We may also bring Saturn to the Ascendant under its own pole. But if we were to bring the Sun to Saturn under the Sun's pole, that would be a *prenatal direction*, for the Sun cannot go back from the position it has attained and sink below the eastern horizon. We have therefore no alternative but to regard these directions as invalid, or to admit the thesis already suggested, that in these directions, made contrary to the apparent motion of the bodies in the heavens, we are dealing with the localised impress of the planet at the moment of birth, which impress is carried by the Earth up the western heavens and down the eastern heavens, so that the Sun's localised imprint is here carried down to the place of Saturn. And this is conformable to the theory of directions under the poles of the significators.



## CHAPTER XII

### THE PART OF FORTUNE

FOR a considerable time there was much discussion as to the correct method of finding the place of the Part of Fortune. This, it should be explained, is one of the old Arabic points, which, like the Pomegranate, the Sword, and others, were regulated by the distances of the several bodies from the Sun in the zodiac, the particular point referred to being the same distance in zodiacal degrees from the Ascendant.

It was when astrologers came to apply this theory to the system of primary directions in vogue that the trouble arose as to the correct method of computing this point.

I think that the easiest expression of the case is this :—the Part of Fortune is a mundane point answering to the distance of the Moon from the Sun in the zodiac. Thus in the horoscope of Ruskin the Moon wants  $21^{\circ} 38'$  from the opposition of the Sun, and therefore the Part of Fortune will be  $21^{\circ} 38'$  below the western horizon in mundo.

Its mundane position will therefore be  $8^{\circ} 22'$  inside the 6th house.

Its meridian distance will be  $68^{\circ} 22'$ , and its pole  $39^{\circ} 13'$ . Under this pole we may direct it to aspects in the zodiac, and in mundo. It has been suggested that the Part of Fortune cannot be directed, but can only receive directions from other significators and the planets. This is surely nonsense. Any point in the heavens having been defined and located is carried by the motion of the Earth on its axis from its radical place to others successively in a direction that is contrary to the rotation of the Earth. Hence the Part of Fortune will here be carried down the heavens from the 6th to the 5th and from that to the 4th house successively, forming both mundane and zodiacal aspects under its own pole. The pole of the Part of Fortune and that of Saturn being near to one another, they must be near a mundane parallel, on the same side of the horizon.

There are, however, other suggested methods of taking the place of the Part of Fortune.

Ptolemy says (bk. iii., ch. xii.): "The Part of Fortune is ascertained by computing the number of degrees between the Sun and Moon, and it is placed at an equal number of degrees from the Ascendant in the order of the signs. It is in all cases, both by day and night, to be computed and set down, that the Moon may hold with it the same relation as that which the Sun may hold with

the Ascendant ; and it thus becomes, as it were, a lunar horoscope or Ascendant."

It is therefore clear that Ptolemy intended degrees of oblique ascension or descension, and not merely degrees in the zodiac, the relations of which, in regard to the horizon of any place, are continually changing.

Thus in the horoscope of Ruskin we have—

O.A. of Sun	. . .	341° 13'	
O.D. of Moon	157° 26'		
add	180° 0'	337° 26'	
		<hr/>	
		3° 47'	Moon to oppos. Sun.
O.D. of 7th	. . .	159° 56'	
		<hr/>	
		156° 9'	O.D. of Part of Fortune.

This gives us a position answering to the 10th degree of Leo, and therefore close to the Moon.

Placidus says : " Let the Sun's oblique ascension taken in the Ascendant be subtracted always from the oblique ascension of the Ascendant, as well in the day as in the night, and the remaining difference be added to the Moon's right ascension ; the sum will be the right ascension of the Part of Fortune, which will have the Moon's declination."

In the example horoscope the oblique ascension of the Ascendant is 339° 56', from which take the Sun's oblique ascension 341° 13' (adding 360 for subtraction), and the remainder is 358° 43', which

add to the right ascension of the Moon  $120^{\circ} 17'$ , and the sum is the right ascension of the Part of Fortune  $119^{\circ} 0'$ .

The right ascension of the *imum cæli* being  $69^{\circ} 56'$ , the meridian distance of the Part of Fortune will be  $49^{\circ} 4'$ , and its semiarc will be that of the Moon,  $52^{\circ} 51'$ , as it has the same declination as the Moon in all cases. Then semiarc  $52^{\circ} 51' - 49^{\circ} 4' = 3^{\circ} 47'$ , which is the same as we derived from the method of Ptolemy. For there we found the oblique descension of the Part of Fortune to be  $156^{\circ} 9'$ ; and the oblique descension of the 7th being  $159^{\circ} 56'$ , the difference is  $3^{\circ} 47'$ .

The method of Placidus appears preferable in that we derive at once the right ascension and meridian distance of the Part of Fortune.

The question is, however, whether either is true, and only directions made by the position as thus derived can settle the point in debate.

To enable the student to at once work out the primary arcs, we here append the speculum in the example horoscope :

R.A.	Ner. Dist.	Semiarc.	Horiz. Arc.	Cusp. Dist.
$119^{\circ} 0'$	$49^{\circ} 4'$	$52^{\circ} 51'$	$3^{\circ} 47'$	$3^{\circ} 47'$

These elements at once suggest that the pole of the Part of Fortune can be found, and direction made by the Part of Fortune in mundo and

zodiac to the planets, just as if it were a definite body.

The fact that it is merely a symbol, a point in space, does not in the least invalidate its significance in human affairs, as some impulsive students have suggested. For what else are the degrees of the zodiac known as the Midheaven and Ascendant? They are points in space which bear a definite relationship to a particular place at a given time. They do not need to be identified with a star in the heavens in order to obtain a significance in the horoscope. Every tyro in astrology knows as an absolute fact that these points have a very demonstrable significance in a horoscope, and that transits of the major planets over these points, and the passing of these points by planets in direction, are attended by events which leave no shadow of doubt that they are an essential part of the signalling apparatus by which we are forewarned of coming events. And if these, why not the Part of Fortune? Call it a "myth" if you like, but understand that a myth is a "veil" designed to hide a truth which a symbol is said to embody. The symbol handed down to us is identical with that used in China and also in Egypt to indicate "land, territory, a field."

## CHAPTER XIII

### LUNAR PARALLAX AND SEMI-DIAMETER

AMONG the problems modernly confronting the student of directional astrology, that of the horizontal parallax of the Moon is perhaps one of the most important and at the same time most perplexing.

The places of the planets as indicated in the horoscope are the geocentric longitudes. They are computed from the standpoint of an observer. But as the place of observation is on the surface of the Earth and not at its centre, the observed position of the Moon will not exactly coincide with its computed geocentric longitude. In the case of the Sun and planets, the distances from the Earth are so great as to render the parallax inconsiderable, that of the Sun being only 9", and the parallaxes of other bodies beyond it being proportionately less. But in regard to the Moon, its nearness to the Earth renders its parallax of importance if we are to regard the Moon as affecting us by its direct ray. The nearer the Earth it may be, the greater is the angle of parallax. It is

therefore greatest at the perigee and least at the apogee of the Moon.

As the amount of parallax depends on the Moon's place in its orbit, we make use of the apogee as a point of departure, and the Moon's distance from that point in its orbit where it is furthest from the Earth is called its anomaly.

By comparing the calculated place with the observed place it has been found that the difference of the two at the apogee is  $53' 53''$ , and at perigee  $61' 23''$ . It will be sufficient for our purpose if we call these  $54'$  and  $61'$  respectively. By the use of the "Ready Reckoner" the amount of the anomaly can always be found for any date or hour, and the corresponding parallax is set against it. The table is here repeated for convenience.

[TABLE

TABLE OF ANOMALY.

Epoch 1800, Jan. 0<sup>d</sup> 0<sup>h</sup> 0<sup>m</sup> = 9<sup>s</sup> 20° 20'.

Years.	Add.	Days.	Add.	Anom.	Hor. Par.
	s ° '		s ° '	s °	'
1	2 28 43	1	0 13 4	0 0	54
2	5 27 27	2	0 26 8	6	55
3	8 26 10	3	1 9 12	12	55
4	0 7 57	4	1 22 16	18	55
5	3 6 40	5	2 5 19	24	55
6	6 5 24	6	2 18 23	1 0	55
7	9 4 7	7	3 1 27	6	55
8	0 15 54	8	3 14 31	12	55
9	3 14 38	9	3 27 35	18	55
10	6 13 21	10	4 10 39	24	56
20	1 9 46	11	4 23 43	2 0	56
40	2 19 32	12	5 6 47	6	56
50	9 2 53	13	5 19 51	12	56
60	3 29 18	14	6 2 55	18	57
70	10 12 39	15	6 15 58	24	57
80	5 9 3	16	6 29 2	3 0	57
90	11 22 24	17	7 12 6	6	58
100	6 18 49	18	7 25 10	12	58
Months.	Add.	19	8 8 14	18	59
January .	0 0 0	20	8 21 18	24	59
February .	1 15 1	21	9 4 22	4 0	59
March .	1 20 50	22	9 17 26	6	59
April .	3 5 51	23	10 0 30	12	60
May .	4 7 48	24	10 13 34	18	60
June .	5 22 49	25	10 26 37	24	60
July .	6 24 46	26	11 9 41	5 0	60
August .	8 9 47	27	11 22 45	6	60
September .	9 24 48	28	0 5 49	12	60
October .	10 26 45	29	0 18 53	18	61
November .	0 11 45	30	1 1 57	24	61
December .	1 13 42	31	1 15 1	6 0	61



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*Example.*—Find the Moon's anomaly for 8th February 1819, and the corresponding horizontal parallax.

		°	'
Epoch 1800 . . .	. 9	20	20
Add 19 . . .	. 9	27	59
February . . .	. 1	15	1
8 days . . .	. 3	14	31
			51
	Anomaly=0		
		17	51

The Moon is therefore within  $18^\circ$  of its apogee or furthest distance from the Earth, and its parallax will therefore be near its minimum. Our table shows that the parallax due to this anomaly is  $55'$ . This would be the difference between the Moon's geocentric longitude and its observed position from the surface of the Earth if it were exactly on the horizon. At the meridian the parallax is 0, and at the horizon it differs, as stated, from  $54'$  to  $61'$  according to the distance of the Moon from the Earth, *i.e.* its place in its orbit.

Now, as the horizon is at all points  $90^\circ$  from the zenith or nadir, we can make one of these the apex of a triangle, of which the zenith distance of the Moon at transit is the perpendicular and the base its meridian distance. From these we may find the hypotenuse, which will be the Moon's zenith distance at the time of birth.

Thus, in the example horoscope the latitude of the place is  $51^\circ 30' \text{ N.}$ , and the Moon has latitude

5° 1' N., which therefore must be subtracted, leaving 46° 29' as the zenith distance of the Moon at transit of the nadir. Its meridian distance is found from the speculum to be 50° 21'. Then

Log. cosine 50° 21'.	. 9.80489
Log. cosine 46° 29'.	. 9.83794
	<hr/>
Log. cosine 63° 52'.	. 9.64283

And as 90° is to 55', so is 63° 52' to 39', which is the Moon's parallax, and by which amount she is apparently depressed further below the horizon than she is computed to be. This will affect its meridian distance, etc. The directions of the Moon, if operating dynamically by right lines of energy upon any part of the Earth instead of *via* the centre of the Earth, will hence be affected; and it remains a problem worth some close study and consideration as to what view ought to be taken. It is sufficient here to have indicated the method of calculation. It is one of the factors in the vexed problem of "the uncertain Moon," which has frequently been charged with an inconstancy altogether absent from the directions of the Sun and planets.

The semi-diameters of the Sun and Moon have often been resorted to in order to accommodate a directional arc to the date of an event. Allowing, as is undoubtedly the case, that primary directions have an orb of influence within the limits of which

it may be said they begin to operate, attain their maximum, and pass off, there yet remains the fact that one would naturally expect the maximum to coincide with the most marked phase of a crisis in the life. This appears to be acknowledged, inasmuch as practitioners in the art of directing make use of arcs of direction, measured from the centres of bodies as determined by their longitudes, in order to correct approximate times of birth. This correction can only be legitimately made on the supposition that arcs of direction are close, if not exact, to the time of the events they are held to signify.

And unless there were this fundamental integrity of the system of direction advocated, unless there was a close agreement throughout a life between the arcs of direction and the events portrayed, there would be no use in making the calculations.

Our longitudes are geocentric and apply to the apparent centre of the bodies. The apparent diameter of the larger planets, on account of their great distance from the Earth, is inconsiderable. But when we come to the Sun and Moon, which are the chief signifiers, and the bodies that are directed to form the aspects of the promissors, we are concerned with orbs that have a visible diameter. The Sun on account of its immense size, and the Moon on account of its close proximity, appear to have a diameter of about half a degree, or from the centre to the limb about  $15'$ . This becomes an

important consideration when we are directing either of them to the aspect or conjunction of one of the planets, inasmuch as from first to last contact of the disc of the luminary with the said planet or aspect there will be an included arc of half a degree, and this means six months of time according to the Ptolemaic measure of  $1^\circ = 1$  year. Hence it may well be that a direction is increscent for three months before it attains its actual centrality and maximum strength, and another three months may transpire before the effects wear off. And if to this we add the fact that directions formed at the tropics, *i.e.* near Cancer or Capricorn 0, are very slow in formation (as may be seen from the Tables of Declination),  $4^\circ$  of longitude including only  $1'$  of declination, it will readily be understood that there is ample room for "latitude" in the timing of events.

It seems desirable, therefore, that a few cases of very well-observed birth-times should be taken, and the arcs of direction computed very closely; and then that these arcs should be compared with the course of events, so that an estimate of the value of the semi-diameters of the Sun and Moon may be made.

The apparent semi-diameter of the Moon is controlled by the same factor as the parallax, namely, its place in the orbit and consequent distance from the Earth. It may be useful to mention that the semi-diameter of the Moon is

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approximately twenty-seven one-hundredths of the parallax. Therefore multiply the parallax by 27 and divide by 100. Thus, when the parallax is 54', the semi-diameter of the Moon is  $54 \times 27 \div 100 = 14\frac{1}{2}'$ , and when the parallax is 60, the semi-diameter is  $60 \times 27 \div 100 = 16'$ .

The Moon directed to the opposition of the Ascendant in the example horoscope works out at  $2^\circ 30'$ ; but as the horizontal parallax of the Moon is 55', its semi-diameter will be nearly 15', and therefore the direction would read :

Asc. oppos. Moon in mundo,	first contact	$2^\circ 15'$
„	„	middle $2^\circ 30'$
„	„	last contact $2^\circ 45'$

thus giving a possible range of  $30'$ , or six months for the duration of this indication. This may help to account for the variability that has been noticed in regard to lunar directions, and possibly we may also have to consider taking the parallax into account. The solar directions will be affected by semi-diameter of the Sun, but not appreciably by parallax.

## CHAPTER XIV

### LUNAR EQUATIONS

UNDER this head I propose to examine a problem of some interest which appears to have escaped general recognition, but which may very well be considered with the questions of parallax and semi-diameter as having some connection with the noted irregularity of primary lunar directions.

Take an illustration from the horoscope already submitted. We would direct the Moon to conjunction with the nadir, which direction is known as "Midheaven opposition Moon in mundo." It is measured by the arc of the Moon's meridian distance,  $50^{\circ} 21'$ , and is formed by the rotation of the Earth on its axis, by which the Moon is carried down the western heavens until it makes its meridian transit.

The theory underlying this direction is that there is a permanent significance and value attaching to the radical positions of the Midheaven, Ascendant, and other significators, which is unaffected by the subsequent changes taking place amongst the planets, either on account of their apparent motions

in the heavens or their real motions in the zodiac. But we have now to consider whether there may not be some value attaching to these subsequent motions of the bodies in the zodiac. These motions, within the narrow limits of time comprised in the formation of directions in a life of ordinary length, would not be appreciable in the case of the planets or the Sun, but in the case of the Moon there would be a quite appreciable increment owing to the velocity of that body in its orbit.

Thus the arc of  $50^{\circ} 21'$  cited above would occupy the interval of 3 hours 25 minutes, during which the Moon will have increased its longitude by about  $1^{\circ} 42'$ , so that it would not actually make the meridian transit for another 7 minutes, although its radical place would then be exactly on the nadir. Its right ascension will be increased by about the same amount, and therefore the actual arc of direction from the time of birth until the bodily transit of the nadir would be about  $52^{\circ} 3'$ . So far as this case is concerned it is worthy of notice that this arc of the second distance of the Moon to the opposition of the Midheaven, and therefore to the mundane square of the Ascendant, coincided exactly with a period of serious illness and trouble in the life of Ruskin, whereas the arc M.C. opposition Moon in mundo,  $50^{\circ} 21'$ , exactly coincided with the election of Ruskin to the Slade Professorship of Fine Art, a distinction which brought him into the highest position in his sphere of life.

Obviously, therefore, the second distance of the Moon is by far the most appropriate.

Let us look at another direction from the same point of view. Direct the Moon under its own pole to the opposition of Saturn.

The Moon's pole is $47^{\circ} 27'$ , and its ascensional difference under that pole, derived in the process of find- ing the pole, is . . . . .	$31^{\circ} 32'$
Its right ascension . . . . .	$120^{\circ} 17'$
Its oblique descension under its pole . . . . .	$151^{\circ} 49'$
Add . . . . .	$180^{\circ} 0'$

Oblique ascension of opposition Moon =  $331^{\circ} 49'$

Then for Saturn's oblique ascension under the same pole—

Pole of Moon	
tang. . . . .	10.03712
Tang. Saturn's	
decl. . . . .	9.08283

Ascl. diff. Saturn

sine . . . . .	9.11995 =	$7^{\circ} 31'$
R.A. of Saturn . . . . .		$348^{\circ} 54'$
O.A. of Saturn . . . . .		$356^{\circ} 25'$ under Moon's pole.
O.A. of Moon's oppos. . . . .		$331^{\circ} 49'$

Arc. of Moon oppos. Saturn =  $24^{\circ} 36'$



This corresponds with Ruskin's leap into public estimation and fame, for which we have the arc of direction Sun sextile Midheaven in mundo. Most certainly the Moon to opposition Saturn could not be regarded as in the least degree akin to the nature of events then current in the life of the great artist.

But this arc took 1h. 38m. 24s. to complete, and during that time the Moon had increased its R.A. by some 49'; and as we are bringing Saturn up to the opposition of the Moon under the pole of the Moon, we shall have to curtail the direction by 49', which results in an arc of  $23^{\circ} 47'$ . This is nearly a year in advance of Ruskin's great advent, and may very well have coincided with a period of stress and indisposition.

The Moon to the opposition of Venus comes into force at about thirty years of age, or in the thirtieth year of life, when he married; but by adding the increment due to the time of direction to the radical place of the Moon we get an arc which falls out a whole year later, when it is certain Ruskin realised his disappointment.

The directions of the Sun during the course of sixty years would only be affected by an increment of 10', and they can always be relied upon; but the directions of the Moon are at present very unsatisfactory, and it has been thought that this question of second distances may serve not only to indicate why lunar primary directions are inconstant, but why also they appear to have a more

enduring influence than those of the Sun. The suggestion is that from the time the direction is formed to the radical position of the Moon to the time that it is formed to the actual position of that body in the heavens, may be the extent of its duration; and during this period, which naturally increases in length as the age increases, transits and other secondary indications may come up repeatedly to reinforce the portents of the lunar direction and bring them into play. Certain it is that there are many conditions affecting the directions of the Moon which arise out of its velocity, and to maintain its ancient reputation for inconstancy and fickleness it appears to have jealously guarded its secret even from the lynx eye of the practical astrologer. Whether we have succeeded in compassing the fickle goddess by this exposition remains to be decided by constant experiment conducted by several independent workers. In the cause of a scientific astrology this is worth carrying out, and it is to be hoped that qualified and unprejudiced students will communicate their experience.

It may assist the average student to know that all directions of the Moon to *succeedent* places will fall out sooner, while those to *precedent* places will fall out later, than indicated by the radical or first distance of the Moon, and the arc of direction must therefore be increased or decreased at the rate of 2' for every degree of the arc of direction. Thus an arc of  $39^{\circ} 15'$  requires  $1^{\circ} 18\frac{1}{2}'$ .

## CHAPTER XV

### CUSPAL DISTANCES

WHEN giving instructions as to the method of directing bodies to aspects of the Ascendant and Midheaven in mundo, it is customary to affirm that one-third of a planet's semiarc is equal to a house-space, so that a planet that is one-third of its semiarc above the horizon is held to be on the cusp of the 12th house, and when two-thirds of its semiarc above the horizon it is on the cusp of the 11th. But if this were actually the case, we should find that when on the cusp of a house the oblique ascension of an ascending planet is the same as the oblique ascension of the cusp of that house. Such is not the case.

*Example.*—Direct the Sun in Ruskin's horoscope to the sextile of the Midheaven in mundo. This aspect falls on the cusp of the 12th house.

The semiarc diurnal of the Sun is  $69^{\circ} 59'$ , and one-third of this is  $23^{\circ} 20'$ , to which add the Sun's distance under the horizon,  $1^{\circ} 17'$ , and we get the arc of direction  $= 24^{\circ} 37'$ . The Sun is then on the cusp of the 12th house presumably. Let us see.

The R.A. of the Midheaven is  $249^{\circ} 56'$ , to which if we add 60 we shall have the oblique ascension of the cusp of the 12th house,  $309^{\circ} 56'$ . Now, when the R.A. of the Midheaven is increased by an arc of  $24^{\circ} 37'$ , the oblique ascension of the cusp of the 12th will be increased by the same amount, and will then be  $334^{\circ} 33'$ , while the oblique ascension of the Sun is  $341^{\circ} 13'$ . Wherein lies the error?

It lies in the fact that we are directing the Sun under the pole of the Ascendant, whereas we should direct it under the pole of the 12th house cusp. I here give a table of the polar elevation due to the various houses in several latitudes, from which, by proportion of their parts, we may derive the pole of any house for any minute of the included latitudes.

POLES OF HOUSES.

Lat.	Cusps of 3, 5, 9, 11.	Cusps of 2, 6, 8, 12.
45	18 57	34 11
46	19 37	35 10
47	20 19	36 10
48	21 2	37 10
49	21 46	38 12
50	22 33	39 15
51	23 21	40 19
52	24 12	41 24
53	25 5	42 31
54	26 1	43 39
55	26 59	44 48

The pole of the 12th house for the latitude  $51^{\circ} 30' \text{ N.}$  is seen to be  $40^{\circ} 51'$ , and if we direct the Sun under this pole we shall have the

Ascensional difference of Sun	
under pole of 12th . . .	$13^{\circ} 36'$
Right ascension of Sun . . .	$321^{\circ} 12'$
	<hr/>
Oblique ascension of Sun under	
pole of 12th . . . . .	$334^{\circ} 48'$
Oblique ascension of cusp of the	
12th house . . . . .	$309^{\circ} 56'$
	<hr/>
Arc of direction . . . . .	$24^{\circ} 52'$

This, although not exact, is certainly nearer, and seems to justify the method of directing under the poles of planets.

The fact, however, is that if we take a fixed pole for any house in a given latitude we shall always be in some degree of error, and for the simple reason that the semi-arcs of the planets, being parallel to the equator, do not lie in the same plane as the prime vertical, which is the circle we divide into twelve equal parts to form the houses of the heavens. Therefore an equal division of the prime vertical will not result in an equal division of the semi-arcs, and either we have to consider the poles of the houses as movable, or, as seems more consistent with the facts, we must regard the house-spaces as unequal. In other words, we shall find that the

time (measured by degrees of R.A.) that the Sun remains in successive houses is unequal, and the same is to be said of any other body. When, therefore, we take one-third of the semiarc of a planet as equal to one house-space, we are indulging in a free use of the metaphysical concept that "all circles are equal to one another," as defined by the doctrine of Correspondences. Against this I have nothing to say except that it is not mathematics.

Now, just as we take the Sun's oblique ascension under the pole of the Ascendant in order to find its distance from the horizon, so we must take its oblique ascension under the pole of the 12th house in order to find its distance from the cusp of the 12th, and its oblique ascension under the pole of the 11th to find its distance from the cusp of the 11th. Its right distance from the cusp of the 10th will be its arc to that cusp, since the meridian has no polar elevation. Thus :

The pole of the Ascendant is	. 51° 30'
The pole of the 12th house .	. 40° 51'
The pole of the 11th house .	. 23° 46'

The Sun's declination is 15° 13', log. tang. 9.64380, and if to this we add the tangent of the poles of the houses successively we shall have the sine of the ascensional differences of the Sun under these poles, which, added to its right ascension, will give its oblique ascension under those poles. These are :

O.A. of Sun under pole of 1st house .	341° 13'
O.A. of Sun under pole of 12th house	334° 48'
O.A. of Sun under pole of 11th house	327° 59'
R.A. of Sun under pole of 10th house	321° 12'

Then, to find the arc of direction between the Sun and any of these cusps, we merely subtract the oblique ascension of the one from the other. The oblique ascensions of the cusps are :

Of the Ascendant . . .	339° 56'
Of the 12th . . . . .	309° 56'
Of the 11th . . . . .	279° 56'
Of the Midheaven R.A.	249° 56'

Thus we have the following true arcs of direction of the Sun in mundo :

O.A. Sun under pole of Ascendant .	341° 13'
O.A. of the Ascendant . . . . .	339° 56'

---

Arc of Sun to conjunction Ascendant    1° 17'

O.A. of Sun under pole of 12th . . .	334° 48'
O.A. of 12th house cusp . . . . .	309° 56'

---

Arc of Sun to sextile Midheaven mundo    24° 52'

O.A. of Sun under pole of 11th . . .	327° 59'
O.A. of cusp of 11th . . . . .	279° 56'

---

Arc of Sun to sextile Ascendant mundo    48° 3'

R.A. of Sun under Meridian . . . . .	321° 12'
R.A. of Midheaven . . . . .	249° 56'

---

71° 16'

And in all these cases the Sun will have the same oblique ascension as the cusp of the house to which it is directed, at the time of direction being completed. This is what we argue for and obtain.

Also we may find the degrees of R.A. which pass under the meridian while the Sun passes from the cusp of one house to the next, and thus the house-space of the Sun at its present declination.

As the whole diurnal arc of the Sun is less than 90, the house-space will be less than 30°.

Subtract the arc of direction of Sun conjunct Ascendant from the arc of direction Sun conjunct 12th = Sun sextile Midheaven. There remains 23° 35', the house-space of 12th house.

Subtract the direction of the Sun to the 12th from that to the 11th; there remains 23° 11', the house-space of the Sun in the 11th. Subtract the arc of direction Sun cusp of the 11th from the Sun conjunct Midheaven; there remains 23° 13', the house-space of the Sun in the 10th.

And the three house-spaces added together = 69° 59', which is the diurnal semiarc of the Sun.

Hence it appears that the mundane directions of planets must be taken in terms of the pole of the cusp to which they are directed. The cuspal distances of the planets must also be measured according to the same rule. This will affect all directions calculated by primary arcs on the semi-arc method now commonly in vogue.

But what appears of most vital importance as



a legitimate conclusion drawn from this critique is that the correct method of directing to any body is by oblique ascension under the pole of that body, which is quite different from taking the direction under the pole of the body directed. At the same time, it appears to dispose of the semiarc method, except as a valuable approximation. For nothing can be more certain than that the cusps of the houses, measured in the prime vertical, are  $30^\circ$  distant from one another by oblique ascension.

These conclusions agree entirely with our mathematics, for we have seen that the house-space of the Sun in the 12th, due to its declination, is  $23^\circ 35'$ ; and if to this we add the Sun's direction (from below) to the Ascendant  $= 1^\circ 17'$ , we have an arc of direction, Sun to conjunction cusp of 12th = Midheaven sextile Sun in mundo,  $24^\circ 52'$ , which is exactly what we found the direction of the Sun to be by oblique ascension when taken under the pole of the 12th house.

This proves, if anything can, not only that the correct method of directing is under the pole of the planet or position directed to, but also that the house-spaces are variable and depend on the several declinations of the planets, and thus on their oblique ascensions and descensions, taken under the poles of the successive houses.

By the semiarc method, taking one-third of a semiarc as equal to a house-space, we are dealing with an approximation which, although useful

and facile, is not mathematically correct. Rather than that bad habits should become popular, I have undertaken a somewhat lengthy demonstration of this point, which I consider to be now settled beyond further debate.

## CHAPTER XVI

### SUGGESTED METHOD OF TRUE DIRECTING

As the result of this examination of the various methods of directing, both by semiarc proportions and by oblique ascensions under the poles, we may come to the conclusion that all the disparities which vitiate the present methods can be disposed of if we proceed along the lines to which our conclusions point. For this purpose we shall require a speculum containing :

1. The right ascension of a planet.
2. Its declination.
3. Its pole.
4. Its ascensional difference under its own pole.

The first of these will, of course, be worked as usual. The declination will be that given in the ephemeris. The pole of the planet will be that derived in the usual way from the ascensional difference of its proportional place in the prime vertical taken under its own declination, as already shown. Its cuspal distance will be the difference between its oblique

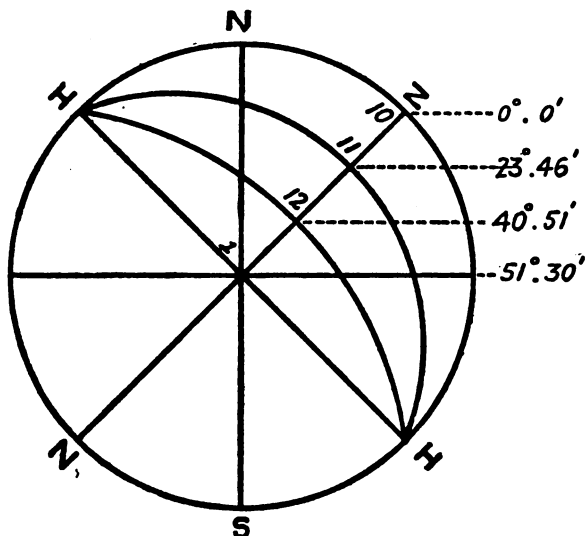
ascension (or descension) taken under the pole of the cusp to which it is nearest and the oblique ascension of the cusp in the prime vertical. These are all the elements required for a complete calculation of all legitimate arcs of direction.

Directions must be made under the pole of the body to which we are directing another. The pole is the same as geographical latitude. It represents the latitude (geographical) or polar elevation (astronomical) at which the cusp of the house cuts into the circle of the prime vertical, or at which a circle of position cuts into it.

Thus in the following diagram let the great circle NZHS, etc., be the sphere of the Earth, of which N is the north pole, S the south pole. Also let ZN be the great circle of the prime vertical at an elevation from the Equator of  $51^{\circ} 30' N.$ , and H-H the horizon intersecting it at right angles. Then HNZH will be the upper meridian and HSNH will be the lower meridian, the points Z and N marking the zenith and the nadir. The cusps of the 10th, 11th, and 12th houses are shown by the great circles cutting through the prime vertical at different elevations, and these answer exactly to the geographical latitudes (north) of the same values. Thus the pole of the Ascendant is  $51^{\circ} 30'$ , that of the 12th,  $40^{\circ} 51'$ , that of the 11th,  $23^{\circ} 46'$ , and that of the 10th,  $0^{\circ} 0'$ , as shown in the diagram, the ascensional difference being the arc in R.A. between N-S and H-H.

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A circle of position is thus seen to be one which passes through a body and converges upon the



horizon north and south exactly like an intermediate cusp of a house.

### *Rules for Directing*

**Rule 1.**—Find the pole of the body or ecliptic position to which direction is to be made. Find the ascensional difference under this pole of the body to be directed. Apply this ascensional difference to the right ascension of the body to be directed, and obtain its oblique ascension (or descension, as the case may require) under the

pole of the body to which direction is made. The difference between this and the oblique ascension of the body to which direction is made, taken under its own pole, will be the *arc of direction*.

*Rule 2.*—In mundane directions take the body of the promittor, i.e. body directed to. In zodiacal directions take its longitude.

*Rule 3.*—In directing to the aspect of a planet in mundo, its cuspal distance taken under its own pole must be directed to under the same pole.

This rule also serves for mundane parallels.

Here is the Speculum required for Ruskin's horoscope.

SPECULUM

Planet.	R.A.	Declin.	Pole.	Ascen. Diff.
Sun . . .	321 12	15 13 9-43458	51 13 10-09493	19 47
Moon . . .	120 17	25 39 9-68142	50 21 10-08147	35 24
Mercury . . .	296 47	21 34 9-59688	44 55 9-99885	23 13
Venus . . .	276 6	18 10 9-51606	27 13 9-71125	9 43
Mars . . .	299 6	21 45 9-60013	46 22 10-02066	24 44
Jupiter . . .	302 37	20 26 9-57119	47 13 10-03355	23 44
Saturn . . .	348 54	6 54 9-08283	45 56 10-01423	7 11
Uranus . . .	262 49	23 24 9-63623	3 13 8-74904	7 27
Neptune . . .	267 47	22 14 9-61148	3 48 8-82147	9 20

## SUGGESTED METHOD OF TRUE DIRECTING 111

### *Examples*

Direct the Sun in mundo to the conjunction with Venus mundo. The pole of Venus is  $27^{\circ} 13'$ , its ascensional difference under that pole is  $9^{\circ} 43'$ , which added to its R.A.,  $276^{\circ} 6'$  (as Venus' declination is S.), gives its oblique ascension under its own pole =  $285^{\circ} 49'$ .

The oblique ascension of Sun under the same pole is—

Pole, log. tang. .  $27^{\circ} 13'$  9.71125

Decl., log. tang. .  $15^{\circ} 13'$  9.43458

---

Asc. diff. log. sine  $8^{\circ} 2'$  9.14583

R.A. of Sun .  $321^{\circ} 12'$

---

O.A. of Sun .  $329^{\circ} 14'$  under Venus' pole.

O.A. Venus .  $285^{\circ} 49'$  „ „ „

---

Arc of direction =  $43^{\circ} 25'$  Sun conj. Venus in mun.

*Note.*—All the tangents being inserted in the speculum under the declinations and poles of the planets, they can be extracted as required.

Direct Uranus to the conjunction with the Moon in mundo.

The pole of the Moon is  $50^{\circ} 21'$ , its ascensional difference under that pole is  $35^{\circ} 24'$ , and its oblique descension  $155^{\circ} 41'$ .

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The declin. of Uranus is  $23^{\circ} 24'$  tan. 9.63623  
Pole of Moon . . .  $50^{\circ} 21'$  tan. 0.08147

---

Asc. diff. under pole .  $31^{\circ} 28'$  sine 9.71770  
Uranus' R.A. . .  $262^{\circ} 49'$

---

O.D. Uranus . .  $231^{\circ} 21'$  under Moon's pole.  
O.D. of Moon. .  $155^{\circ} 41'$  „ „ „

---

Arc of direction =  $75^{\circ} 40'$  Uranus conj. Moon  
in mundo.

These directions take very much less time to calculate than to set out in writing, and with the speculum at hand they are readily figured out in a minute or two.

Direct the Moon to opposition of Venus in mundo.

Oblique descension of the opposition of Venus =  $105^{\circ} 49'$ .

This is taken under the pole of Venus, from Venus' oblique ascension less  $180^{\circ}$  = oblique ascension of the opposite point.

Oblique descension of Moon under Venus'  
pole . . . . .  $134^{\circ} 37'$   
Oblique descension of Venus under same  
pole . . . . .  $105^{\circ} 49'$

---

Arc of Direction, Moon oppos. Venus  
mundo . . . . .  $28^{\circ} 48'$



## SUGGESTED METHOD OF TRUE DIRECTING 113

These examples will doubtless serve for all conjunctions in mundo. For zodiacal directions it will be necessary to find the declination of the degree of the ecliptic held by a planet to which direction is made, or of its aspect, and add the log. tang. of this declination to the log. tang. of its pole. This will give the ascensional difference under that pole. Apply this to the right ascension to get its oblique ascension or oblique descension under that pole. The difference between this and the oblique ascension (or descension) of the planet directed, taken under the same pole, will be the arc of direction.

Planets having the same pole are either in mundane conjunction or in mundane parallel. This gives us the hint as to the calculation of mundane parallels.

Find the oblique ascension or oblique descension of the planet on which the parallel is formed, taken under its own pole. Find the oblique ascension or oblique descension (as the case may require) of the planet forming the parallel, under the same pole. The difference will be the arc of direction.

*Example* 1. — Bring Saturn in the example horoscope to the mundane parallel of the Moon.

This direction is formed by Saturn coming up to the pole of the Moon on the other side of the meridian.

Right ascension of the Midheaven .	249° 56'
Oblique descension of Moon under its own pole . . . . .	155° 45'
Moon's distance from Midheaven, westward . . . . .	94° 11'
Added to R.A. of M.C. .	249° 56'
Oblique ascension of the parallel, eastward . . . . .	344° 7'
Oblique ascension of Saturn under Moon's pole . . . . .	357° 18'
Arc of direction = difference .	13° 11'

This arc of direction, when computed by the semiarc method, is seen to be 8' short of the actual figures, which throws the time out nearly two months. The arc by that method is 13° 3' as compared with 13° 11', the true arc.

*Example 2.*—Bring Uranus to the mundane parallel of Sun in mundo. Here the planet descends the western horizon until it comes to the same pole westward as the Sun holds eastward.

Oblique ascension of the Sun under its own pole, 51° 13' . . . .	340° 59'
Subtract 180 . . . . .	180° 0'
Oblique descension of aspect below west horizon . . . . .	160° 59'
Oblique descension of Uranus under pole of Sun . . . . .	230° 14'
Arc of direction, Uranus parallel Sun mundo . . . . .	69° 15'

This arc of direction by the semiarc method is found to be  $70^{\circ} 57'$ , which shows an error of  $1^{\circ} 42'$ , equal to one year and eight months of time.

### *Time Measure for Arcs*

This remark brings me back again to the question of the equation of time, so much in dispute among astrologers. I think there can be little doubt that the true method is "a day for a year," which is certainly the most ancient method, as it is also the most uniform. In twenty-four hours the Earth revolves on its axis and the Sun comes again to the same meridian, having in the interval increased its longitude by more or less than a degree according to its apparent place in its orbit, *i.e.* the season of the year. The mean rate of its motion is  $59' 8''$ . Then, as all our calculations are made in terms of equatorial degrees, we have to make a proportion  $59' 8''$  to  $60'$ , and this gives  $24\text{h. } 21\text{m.} = 1 \text{ year } 5.334 \text{ days} = 1 \text{ year } 5\text{d. } 8\text{h.}$  for each  $1^{\circ}$  in the arc of direction. Thus every  $6^{\circ}$  in the arc of direction will give an extra month, to be added to the time at the rate of  $1^{\circ} = 1 \text{ year}$ , which is the measure of time used in the semiarc method. If we add  $5'$  for every  $6^{\circ}$  of arc it will come to the same thing approximately. The measure of a degree of R.A. for a year is due to Placidus. That of the Sun's mean motion, or  $1^{\circ} \text{ R.A.} = 1 \text{ year } 5 \text{ days}$ , is due to Valentine Naibod. Both are a compromise with facts. The probability is that we ought to

take the measure according to the season of the year in which the birth takes place, and hence the Sun's actual increase of R.A. on that date, since the Sun is in every natural sense the great chronocrater, or time-maker. Thus, in the case of Ruskin, who was born on the 8th February, the Sun's diurnal increase of R.A. is  $3' 57'' = 59' 15''$  in arc, but its increase in longitude is  $60' 43''$ , and this being an excess  $1' 35''$  over the mean motion in the zodiac, an arc of direction, at the rate of a day for a year, would measure to so much less, at the rate of about  $1\frac{1}{2}$  minutes for every complete degree of the arc. It will thus be seen that the question of the validity of one method over another in primary directions does not rest entirely on the astronomical facts, but also upon the value we attach to the arcs of direction when obtained. As to the astronomy of the case, there is not the slightest doubt in my mind that the method of directing under the pole of the significator is the correct mathematical scheme. But as to the measure of time from arcs thus derived, this is a matter of experiment, and one needs to exhaust all the evidence before coming to a conclusion.

## CHAPTER XVII

### CONCLUSION

IN the foregoing pages I have endeavoured to set out and critically examine the methods of directing advocated by Ptolemy and Placidus as modernly represented ; and I have further sought to establish their validity on general principles. I have not been blind to their imperfections, and have clearly indicated my view of the semiarc method, derived from the principles laid down by these great pioneers of a scientific astrology, when I speak of them as valuable approximations. The discrepancies are those due to incorrect use of words in describing the facts. The term "corresponding to" should be more frequently used in the semiarc method in place of the term "equal to." It is admitted that in both systems—that of proportional semiarcs and that of direction under poles—we are concerned with the apparent places of the planets in the prime vertical, and therefore when we speak of planets as being directed to a conjunction we mean an apparent conjunction as seen from the place of birth, and not either in the zodiac or by

right ascension, but solely in the prime vertical or circle of observation, which coincides neither with the Equator nor the Ecliptic. Therefore, when we come to the test we find without doubt that the only way of doing this is to bring the directed body along its own arc or parallel of declination to the same pole as the promittor or body directed to. Also, it is apparent that as polar elevation is measured from the zenith in the plane of the prime vertical, planets having the same pole must be in mundane conjunction if on the same side of the meridian, or in mundane parallel if on opposite sides, which fact renders the calculation of mundane parallels a process of such extreme simplicity that I wonder it has never been pointed out before.

To correct the errors arising out of the methods of Ptolemy and Placidus, I have made a complete statement of the true doctrine of polar directions in the plane of the prime vertical, and have supplemented this by a speculum drawn according to the principles laid down, so that by mere inspection of the same, and very little figuring, all directions in mundo can be calculated. For directions in the zodiac it will be necessary to have the pole of the aspect or position in the zodiac, which can be determined by the longitudinal distance from the cusp of the house taken in proportion to the degrees of the ecliptic included in that house from the Table of Poles of the Houses, and from this we get its oblique ascension or oblique de-

scension under its own pole. and direct to it as in mundane direction.

In effect, it will be found that with a set of tables of oblique ascension, and one of tables of poles, all directions can be correctly calculated in a fraction of the time usually devoted to them, even by the very facile but faulty method of proportion of semiarcs. I have fairly stated both cases, and criticised only where criticism was necessary to correct error. In this I have done no hurt to the cause of scientific astrology, and I conclude this treatise in the earnest belief that I have even done some small service.





# TABLES FOR THE USE OF ASTROLOGICAL STUDENTS

INCLUDING TABLES OF LOGARITHMIC  
SINES, TANGENTS, ETC., TABLES OF  
RIGHT ASCENSION, DECLINA-  
TION, AND ASCENSIONAL  
DIFFERENCE, AND TER-  
NARY PROPORTIONAL  
LOGARITHMS



**TABLES OF LOGARITHMIC  
SINES, TANGENTS, ETC.**



[0 degrees.]

	Diff.	Tangent.	Diff.	Cotang.	Cosine.	
0	—	—	—	+	0.00000	60
1	6.46173	6.46173	13.55627	13.55627	0.00000	59
2	6.76476	6.76476	13.23524	13.23524	0.00000	58
3	6.94085	6.94085	12.91515	12.91515	0.00000	57
4	7.06579	7.06579	12.59441	12.59441	0.00000	56
5	7.16270	7.16270	12.27370	12.27370	0.00000	55
6	7.24188	7.24188	11.95312	11.95312	0.00000	54
7	7.30882	7.30882	11.63267	11.63267	0.00000	53
8	7.36682	7.36682	11.31238	11.31238	0.00000	52
9	7.41797	7.41797	10.99223	10.99223	0.00000	51
10	7.46373	7.46373	10.67223	10.67223	0.00000	50
11	7.50512	7.50512	10.35238	10.35238	0.00000	49
12	7.54291	7.54291	10.03267	10.03267	0.00000	48
13	7.57767	7.57767	9.71319	9.71319	0.00000	47
14	7.60985	7.60985	9.39386	9.39386	0.00000	46
15	7.63982	7.63982	9.07467	9.07467	0.00000	45
16	7.66784	7.66784	8.75562	8.75562	0.00000	44
17	7.69417	7.69417	8.43671	8.43671	0.00000	43
18	7.71900	7.71900	8.11794	8.11794	0.00000	42
19	7.74248	7.74248	7.79931	7.79931	0.00000	41
20	7.76475	7.76475	7.48081	7.48081	0.00000	40
21	7.78594	7.78594	7.16245	7.16245	0.00000	39
22	7.80615	7.80615	6.84423	6.84423	0.00000	38
23	7.82545	7.82545	6.52614	6.52614	0.00000	37
24	7.84393	7.84393	6.20819	6.20819	0.00000	36
25	7.86166	7.86166	5.89038	5.89038	0.00000	35
26	7.87870	7.87870	5.57271	5.57271	0.00000	34
27	7.89509	7.89509	5.25518	5.25518	0.00000	33
28	7.91088	7.91088	4.93779	4.93779	0.00000	32
29	7.92612	7.92612	4.62054	4.62054	0.00000	31
30	7.94084	7.94084	4.30343	4.30343	0.00000	30

[89 degrees.]

[0 degrees.]

	Diff.	Tangent.	Diff.	Cotang.	Cosine.	
30	7.94086	7.94086	14.24	12.05914	0.99998	30
31	7.95510	7.95510	13.79	12.04490	0.99998	29
32	7.96887	7.96887	13.36	12.03111	0.99998	28
33	7.98223	7.98223	12.97	12.01775	0.99998	27
34	7.99520	7.99520	12.59	12.00478	0.99998	26
35	8.00779	8.00779	12.23	11.99219	0.99998	25
36	8.02002	8.02002	11.88	11.97996	0.99998	24
37	8.03194	8.03194	11.55	11.96806	0.99997	23
38	8.04350	8.04350	11.23	11.95647	0.99997	22
39	8.05478	8.05478	10.92	11.94519	0.99997	21
40	8.06578	8.06578	10.62	11.93419	0.99997	20
41	8.07650	8.07650	10.32	11.92347	0.99997	19
42	8.08696	8.08696	10.02	11.91300	0.99997	18
43	8.09718	8.09718	9.72	11.90278	0.99997	17
44	8.10717	8.10717	9.42	11.89280	0.99996	16
45	8.11693	8.11693	9.12	11.88304	0.99996	15
46	8.12647	8.12647	8.82	11.87349	0.99996	14
47	8.13581	8.13581	8.52	11.86415	0.99996	13
48	8.14495	8.14495	8.22	11.85500	0.99996	12
49	8.15395	8.15395	7.92	11.84603	0.99995	11
50	8.16273	8.16273	7.62	11.83727	0.99995	10
51	8.17128	8.17128	7.32	11.82867	0.99995	9
52	8.17971	8.17971	7.02	11.82024	0.99995	8
53	8.18798	8.18798	6.72	11.81196	0.99995	7
54	8.19610	8.19610	6.42	11.80384	0.99995	6
55	8.20407	8.20407	6.12	11.79587	0.99994	5
56	8.21189	8.21189	5.82	11.78805	0.99994	4
57	8.21958	8.21958	5.52	11.78036	0.99994	3
58	8.22720	8.22720	5.22	11.77280	0.99994	2
59	8.23456	8.23456	4.92	11.76538	0.99994	1
60	8.24186	8.24186	4.62	11.75808	0.99993	0

[89 degrees.]

[1 degree.]

	Sine.	Diff.	Tangent.	Coang.	Coang.	Coang.	
30	8.41792	480	8.41807	Diff.	Coang.	Coang.	
31	8.42272	474	8.42287	480	11.58103	9.99855	30
32	8.42746	475	8.42762	474	11.57713	9.99855	29
33	8.43216	464	8.43232	470	11.57338	9.99854	28
34	8.43680	459	8.43696	464	11.56968	9.99854	27
35	8.44139	455	8.44156	460	11.56604	9.99854	26
36	8.44594	445	8.44611	455	11.56244	9.99853	25
37	8.45044	440	8.45061	450	11.55884	9.99853	24
38	8.45489	441	8.45507	445	11.55539	9.99853	23
39	8.45930	436	8.45948	441	11.55191	9.99852	22
40	8.46366	433	8.46385	437	11.54840	9.99852	21
41	8.46799	427	8.46817	432	11.54485	9.99851	20
42	8.47226	424	8.47245	428	11.54133	9.99851	19
43	8.47650	419	8.47669	424	11.53783	9.99851	18
44	8.48069	416	8.48089	416	11.53431	9.99851	17
45	8.48485	411	8.48505	412	11.53077	9.99850	16
46	8.48896	408	8.48917	408	11.52721	9.99850	15
47	8.49304	404	8.49325	404	11.52363	9.99849	14
48	8.49708	400	8.49729	401	11.52003	9.99849	13
49	8.50108	396	8.50130	397	11.51641	9.99849	12
50	8.50504	393	8.50527	393	11.51277	9.99848	11
51	8.50897	390	8.50920	390	11.50911	9.99848	10
52	8.51287	386	8.51310	386	11.50543	9.99847	9
53	8.51673	382	8.51696	383	11.50173	9.99847	8
54	8.52055	379	8.52079	380	11.49800	9.99847	7
55	8.52434	376	8.52459	376	11.49424	9.99846	6
56	8.52810	373	8.52835	373	11.49046	9.99846	5
57	8.53183	369	8.53208	373	11.48666	9.99845	4
58	8.53552	367	8.53578	369	11.48283	9.99845	3
59	8.53919	363	8.53945	363	11.47897	9.99844	2
60	8.54282	363	8.54308	363	11.47509	9.99844	1
					11.47119	9.99844	0

[88 degrees.]

[1 degree.]

	Sine.	Diff.	Tangent.	Coang.	Coang.	Coang.	
0	8.24186	717	8.24192	718	11.73808	9.99993	60
1	8.24493	706	8.24490	706	11.73590	9.99993	59
2	8.24809	695	8.24806	696	11.73384	9.99993	58
3	8.25124	684	8.25122	684	11.73188	9.99993	57
4	8.25438	673	8.25436	673	11.72994	9.99993	56
5	8.25761	663	8.25760	663	11.72800	9.99992	55
6	8.26084	653	8.26083	653	11.72606	9.99992	54
7	8.26407	644	8.26406	644	11.72412	9.99992	53
8	8.26731	634	8.26730	634	11.72218	9.99992	52
9	8.27054	624	8.27053	624	11.72024	9.99992	51
10	8.27377	616	8.27376	616	11.71830	9.99991	50
11	8.27701	608	8.27700	607	11.71636	9.99991	49
12	8.28024	599	8.28023	599	11.71442	9.99991	48
13	8.28347	590	8.28346	591	11.71248	9.99990	47
14	8.28670	583	8.28669	584	11.71054	9.99990	46
15	8.28993	575	8.28992	575	11.70860	9.99990	45
16	8.29316	568	8.29315	568	11.70666	9.99989	44
17	8.29639	560	8.29638	561	11.70472	9.99989	43
18	8.29962	553	8.29961	553	11.70278	9.99989	42
19	8.30285	547	8.30284	546	11.70084	9.99988	41
20	8.30608	539	8.30607	540	11.69890	9.99988	40
21	8.30931	533	8.30930	533	11.69696	9.99988	39
22	8.31254	526	8.31253	527	11.69502	9.99988	38
23	8.31577	520	8.31576	520	11.69308	9.99987	37
24	8.31899	514	8.31898	514	11.69114	9.99987	36
25	8.32222	508	8.32221	509	11.68920	9.99987	35
26	8.32545	502	8.32544	502	11.68726	9.99987	34
27	8.32868	496	8.32867	496	11.68532	9.99986	33
28	8.33191	491	8.33190	491	11.68338	9.99986	32
29	8.33514	485	8.33513	486	11.68144	9.99986	31
30	8.33837	480	8.33836	480	11.67950	9.99985	30
					11.67756	9.99985	

[88 degrees.]

**[2 degrees.]**

		Slms.	Diff.	Tangent.	Diff.	Colang.	Colang.	
0	8-44382	360	8-54308	361	11-45602	9-99074	60	
1	8-44642	357	8-54669	358	11-45332	9-99073	59	
2	8-54999	354	8-55027	355	11-44973	9-99073	58	
3	8-55154	351	8-55182	352	11-44618	9-99072	57	
4	8-55305	349	8-55334	349	11-44266	9-99072	56	
5	8-56054	346	8-56083	346	11-43917	9-99071	55	
6	8-56600	343	8-56629	344	11-43571	9-99071	54	
7	8-56743	341	8-56773	341	11-43227	9-99070	53	
8	8-57084	337	8-57114	338	11-42886	9-99070	52	
9	8-57421	336	8-57452	336	11-42548	9-99069	51	
10	8-57757	332	8-57788	333	11-42212	9-99066	50	
11	8-58089	330	8-58121	330	11-41879	9-99066	49	
12	8-58419	328	8-58451	328	11-41549	9-99068	48	
13	8-58747	325	8-58779	326	11-41221	9-99067	47	
14	8-59072	323	8-59105	323	11-40895	9-99067	46	
15	8-59395	320	8-59428	321	11-40572	9-99067	45	
16	8-59715	318	8-59749	319	11-40251	9-99066	44	
17	8-60033	316	8-60068	316	11-39932	9-99066	43	
18	8-60349	313	8-60384	314	11-39616	9-99065	42	
19	8-60662	311	8-60698	311	11-39302	9-99064	41	
20	8-60973	309	8-61009	310	11-38991	9-99064	40	
21	8-61282	307	8-61319	307	11-38681	9-99063	39	
22	8-61588	305	8-61626	305	11-38374	9-99063	38	
23	8-61894	302	8-61931	303	11-38069	9-99062	37	
24	8-62199	301	8-62234	301	11-37766	9-99062	36	
25	8-62497	298	8-62535	299	11-37466	9-99061	35	
26	8-62795	296	8-62834	297	11-37166	9-99061	34	
27	8-63091	294	8-63131	295	11-36869	9-99060	33	
28	8-63385	291	8-63426	292	11-36574	9-99060	32	
29	8-63678	290	8-63718	291	11-36282	9-99059	31	
30	8-63968	287	8-64009	288	11-35991	9-99059	30	
			Colang.		Tangent.	Colang.		

**[87 degrees.]**

[2 degrees.]

	Slane.	Teagant.	Coltag.	Coltane.	
30	8'63068	8'64009	11'15991	9'99959	30
31	8'64256	8'64298	11'15702	9'99958	20
32	8'64343	8'64385	11'15415	9'99958	28
33	8'64387	8'64870	11'15120	9'99957	27
34	8'65110	8'65154	11'13486	9'99956	26
35	8'65391	8'65435	11'13465	9'99956	28
36	8'65947	8'66715	11'13485	9'99955	25
37	8'65947	8'65993	11'13407	9'99955	23
38	8'66223	8'66269	11'13373	9'99954	22
39	8'66297	8'66493	11'13457	9'99954	21
40	8'66769	8'66816	11'13184	9'99953	20
41	8'67039	8'67087	11'13191	9'99952	19
42	8'67308	8'67356	11'13044	9'99952	18
43	8'67575	8'67624	11'13376	9'99951	17
44	8'67841	8'67890	11'13210	9'99951	16
45	8'68104	8'68147	11'13186	9'99950	15
46	8'68307	8'68347	11'13158	9'99950	14
47	8'68621	8'68678	11'13132	9'99949	13
48	8'68886	8'68938	11'13102	9'99948	12
49	8'69144	8'69196	11'13084	9'99948	11
50	8'69400	8'69453	11'13057	9'99947	10
51	8'69654	8'69708	11'13029	9'99946	9
52	8'69907	8'69962	11'13003	9'99946	8
53	8'70159	8'70214	11'12978	9'99945	7
54	8'70409	8'70465	11'12953	9'99944	6
55	8'70658	8'70714	11'12928	9'99944	5
56	8'70905	8'70962	11'12903	9'99943	4
57	8'71151	8'71208	11'12879	9'99943	3
58	8'71395	8'71453	11'12854	9'99943	2
59	8'71638	8'71697	11'12830	9'99941	1
60	8'71880	8'71940	11'12806	9'99940	0
	Coltane.	Coltag.	Tangent.	Sl.	

[87 degrees.]

[1 degree.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cotang.	'
30	8°41'792	480	8°41'807	480	11°58'193	9°99'85	30
31	8°42'372	474	8°42'387	475	11°57'713	9°99'85	29
32	8°42'746	470	8°42'761	470	11°57'238	9°99'84	28
33	8°43'126	464	8°43'142	464	11°56'768	9°99'84	27
34	8°43'680	460	8°43'696	460	11°56'304	9°99'84	26
35	8°44'139	455	8°44'156	455	11°55'844	9°99'83	25
36	8°44'594	450	8°44'611	450	11°55'389	9°99'83	24
37	8°45'044	445	8°45'061	445	11°54'939	9°99'83	23
38	8°45'489	441	8°45'507	441	11°54'493	9°99'82	22
39	8°45'930	436	8°45'948	437	11°54'043	9°99'82	21
40	8°46'166	433	8°46'183	433	11°53'615	9°99'82	20
41	8°46'799	427	8°46'817	428	11°53'183	9°99'81	19
42	8°47'246	424	8°47'263	424	11°52'755	9°99'81	18
43	8°47'649	419	8°47'669	420	11°52'331	9°99'81	17
44	8°48'069	416	8°48'089	416	11°51'911	9°99'80	16
45	8°48'485	411	8°48'505	412	11°51'495	9°99'80	15
46	8°48'896	408	8°48'917	408	11°51'083	9°99'79	14
47	8°49'304	404	8°49'325	404	11°50'675	9°99'79	13
48	8°49'708	400	8°49'729	401	11°50'271	9°99'79	12
49	8°50'108	396	8°50'130	397	11°49'870	9°99'78	11
50	8°50'504	393	8°50'527	393	11°49'473	9°99'78	10
51	8°50'897	390	8°50'920	390	11°49'080	9°99'77	9
52	8°51'287	386	8°51'310	386	11°48'690	9°99'77	8
53	8°51'673	382	8°51'696	383	11°48'304	9°99'77	7
54	8°52'055	379	8°52'079	380	11°47'921	9°99'76	6
55	8°52'434	376	8°52'459	376	11°47'543	9°99'76	5
56	8°52'810	373	8°52'835	373	11°47'165	9°99'75	4
57	8°53'183	369	8°53'208	373	11°46'792	9°99'75	3
58	8°53'552	367	8°53'578	370	11°46'422	9°99'74	2
59	8°53'919	363	8°53'945	363	11°46'055	9°99'74	1
60	8°54'282		8°54'308		11°45'692	9°99'74	0
'	Cotang.	Diff.	Tangent.	Diff.	Cotang.	Sine.	'

[88 degrees.]

[1 degree.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cotang.	'
0	8°24'186	717	8°24'192	718	11°75'508	9°99'93	60
1	8°24'593	706	8°24'601	706	11°75'090	9°99'93	59
2	8°25'009	695	8°25'016	696	11°74'384	9°99'93	58
3	8°25'604	684	8°25'612	684	11°73'688	9°99'93	57
4	8°26'088	673	8°26'096	673	11°73'004	9°99'92	56
5	8°26'661	663	8°26'669	663	11°72'331	9°99'92	55
6	8°28'324	653	8°28'332	654	11°71'668	9°99'92	54
7	8°28'979	644	8°28'986	643	11°71'014	9°99'92	53
8	8°29'621	634	8°29'629	634	11°70'371	9°99'92	52
9	8°30'255	624	8°30'263	625	11°69'737	9°99'91	51
10	8°30'879	616	8°30'888	617	11°69'112	9°99'91	50
11	8°31'495	608	8°31'505	607	11°68'495	9°99'91	49
12	8°32'103	599	8°32'112	599	11°67'888	9°99'90	48
13	8°32'702	590	8°32'711	591	11°67'289	9°99'90	47
14	8°33'292	583	8°33'302	584	11°66'698	9°99'90	46
15	8°33'875	575	8°33'886	575	11°66'114	9°99'90	45
16	8°34'450	568	8°34'461	568	11°65'539	9°99'89	44
17	8°35'018	560	8°35'029	561	11°64'971	9°99'89	43
18	8°35'578	553	8°35'590	553	11°64'410	9°99'89	42
19	8°36'131	547	8°36'143	546	11°63'857	9°99'89	41
20	8°36'678	539	8°36'689	540	11°63'311	9°99'88	40
21	8°37'217	533	8°37'229	533	11°62'771	9°99'88	39
22	8°37'750	526	8°37'762	527	11°62'238	9°99'88	38
23	8°38'276	520	8°38'289	520	11°61'711	9°99'87	37
24	8°38'796	514	8°38'809	514	11°61'191	9°99'87	36
25	8°39'313	508	8°39'323	509	11°60'677	9°99'87	35
26	8°39'818	502	8°39'832	502	11°60'168	9°99'86	34
27	8°40'320	496	8°40'330	496	11°59'666	9°99'86	33
28	8°40'816	491	8°40'830	491	11°59'170	9°99'86	32
29	8°41'307	485	8°41'321	486	11°58'679	9°99'85	31
30	8°41'792		8°41'807		11°58'193	9°99'85	30
'	Cotang.	Diff.	Tangent.	Diff.	Cotang.	Sine.	'

[88 degrees.]



[2 degrees.]

°	′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
0	8-54-48-2	360	8-54-108	361	11-45-69-2	9-9997-4	60	
1	8-54-62-3	357	8-54-66-9	358	11-45-33-1	9-9997-3	59	
2	8-54-99-9	355	8-55-02-7	355	11-44-97-3	9-9997-3	58	
3	8-55-35-4	351	8-55-38-2	352	11-44-61-8	9-9997-2	57	
4	8-55-70-5	349	8-55-73-4	349	11-44-26-6	9-9997-2	56	
5	8-56-05-4	346	8-56-08-3	346	11-43-91-7	9-9997-1	55	
6	8-56-40-0	343	8-56-42-9	344	11-43-57-1	9-9997-1	54	
7	8-56-74-3	341	8-56-77-3	341	11-43-22-7	9-9997-0	53	
8	8-57-08-4	337	8-57-11-4	338	11-42-88-6	9-9997-0	52	
9	8-57-42-1	336	8-57-45-2	336	11-42-54-8	9-9996-9	51	
10	8-57-57-7	332	8-57-78-8	333	11-42-21-2	9-9996-9	50	
11	8-58-08-9	330	8-58-12-1	330	11-41-87-9	9-9996-8	49	
12	8-58-41-9	328	8-58-45-1	328	11-41-54-9	9-9996-8	48	
13	8-58-74-7	325	8-58-77-9	326	11-41-22-1	9-9996-7	47	
14	8-59-07-2	323	8-59-10-5	323	11-40-89-5	9-9996-7	46	
15	8-59-39-5	320	8-59-42-8	321	11-40-57-2	9-9996-7	45	
16	8-59-71-5	318	8-59-74-9	319	11-40-25-1	9-9996-6	44	
17	8-60-03-3	316	8-60-06-8	316	11-39-53-2	9-9996-6	43	
18	8-60-34-9	313	8-60-38-4	314	11-39-21-6	9-9996-5	42	
19	8-60-66-2	311	8-60-69-8	311	11-38-50-2	9-9996-4	41	
20	8-60-97-3	309	8-61-00-9	310	11-38-18-1	9-9996-4	40	
21	8-61-28-2	307	8-61-31-9	307	11-37-46-1	9-9996-3	39	
22	8-61-58-9	305	8-61-62-6	305	11-37-14-7	9-9996-3	38	
23	8-61-89-4	302	8-61-93-1	303	11-36-43-1	9-9996-2	37	
24	8-61-96-6	301	8-62-00-3	301	11-36-11-6	9-9996-2	36	
25	8-62-49-7	298	8-62-53-5	299	11-35-40-5	9-9996-1	35	
26	8-62-79-5	296	8-62-83-4	297	11-35-09-9	9-9996-1	34	
27	8-63-09-1	294	8-63-13-1	295	11-34-38-9	9-9996-0	33	
28	8-63-38-5	293	8-63-42-6	293	11-34-08-2	9-9996-0	32	
29	8-63-67-8	291	8-63-71-8	291	11-33-37-8	9-9995-9	31	
30	8-63-96-8		8-64-00-9		11-33-07-1	9-9995-9	30	
°	′	Cosine.	Cotang.	Tangent.	Diff.	Cotang.	Sine.	′

[87 degrees.]

[2 degrees.]

°	′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
30	8-63-96-8	288	8-64-00-9	289	11-32-59-1	9-9995-8	30	
31	8-64-26-6	287	8-64-30-8	287	11-32-28-2	9-9995-8	29	
32	8-64-54-3	284	8-64-58-5	285	11-31-56-5	9-9995-8	28	
33	8-64-82-7	283	8-64-87-0	284	11-31-25-0	9-9995-7	27	
34	8-65-11-0	281	8-65-15-4	281	11-30-53-8	9-9995-6	26	
35	8-65-39-1	279	8-65-43-5	280	11-30-22-9	9-9995-6	25	
36	8-65-67-0	277	8-65-71-5	278	11-29-52-3	9-9995-5	24	
37	8-65-94-7	276	8-65-99-3	276	11-29-21-3	9-9995-5	23	
38	8-66-22-3	274	8-66-26-9	274	11-28-50-6	9-9995-4	22	
39	8-66-49-7	272	8-66-54-3	273	11-28-19-7	9-9995-4	21	
40	8-66-76-9	270	8-66-81-6	271	11-27-49-1	9-9995-3	20	
41	8-67-03-9	269	8-67-08-7	269	11-27-18-3	9-9995-3	19	
42	8-67-30-8	267	8-67-35-6	268	11-26-47-8	9-9995-2	18	
43	8-67-57-5	266	8-67-62-4	266	11-26-17-1	9-9995-1	17	
44	8-67-84-1	263	8-67-89-0	264	11-25-46-6	9-9995-1	16	
45	8-68-10-4	261	8-68-15-4	261	11-25-16-2	9-9995-0	15	
46	8-68-36-7	260	8-68-41-7	260	11-24-45-9	9-9994-9	14	
47	8-68-62-7	259	8-68-67-8	259	11-24-15-8	9-9994-9	13	
48	8-68-88-6	258	8-68-93-8	258	11-23-45-8	9-9994-8	12	
49	8-69-14-4	257	8-69-19-6	257	11-23-15-8	9-9994-8	11	
50	8-69-40-0	255	8-69-45-3	255	11-22-45-7	9-9994-7	10	
51	8-69-65-4	253	8-69-70-8	254	11-22-15-8	9-9994-6	9	
52	8-69-90-7	252	8-69-96-2	252	11-21-45-9	9-9994-6	8	
53	8-70-15-9	251	8-70-21-4	251	11-21-16-0	9-9994-5	7	
54	8-70-40-9	249	8-70-46-5	249	11-20-46-1	9-9994-4	6	
55	8-70-65-8	247	8-70-71-4	248	11-20-16-3	9-9994-4	5	
56	8-70-90-5	246	8-70-96-2	246	11-19-46-6	9-9994-3	4	
57	8-71-15-1	244	8-71-20-8	245	11-19-16-9	9-9994-2	3	
58	8-71-39-5	243	8-71-45-3	244	11-18-47-3	9-9994-2	2	
59	8-71-63-8	242	8-71-69-7	243	11-18-17-8	9-9994-1	1	
60	8-71-88-0		8-71-94-0		11-17-48-6	9-9994-0	0	
°	′	Cosine.	Cotang.	Tangent.	Diff.	Cotang.	Sine.	′

[87 degrees.]

[3 degrees.]

'	Size.	Diff.	Tangent.	Diff.	Cotang.	Co-line.	'
0	8°1880	240	8°71940	241	11°28060	9°99940	60
1	8°72120	239	8°72181	239	11°27819	9°99940	59
2	8°72359	238	8°72420	239	11°27580	9°99939	58
3	8°72597	237	8°72659	237	11°27341	9°99938	57
4	8°72834	235	8°72896	236	11°27104	9°99938	56
5	8°73069	234	8°73132	234	11°26868	9°99937	55
6	8°73303	232	8°73366	234	11°26634	9°99936	54
7	8°73535	231	8°73600	232	11°26400	9°99936	53
8	8°73767	230	8°73832	231	11°26168	9°99935	52
9	8°73997	229	8°74063	229	11°25937	9°99934	51
10	8°74226	228	8°74292	229	11°25708	9°99934	50
11	8°74454	226	8°74521	227	11°25479	9°99933	49
12	8°74680	226	8°74748	226	11°25252	9°99932	48
13	8°74906	224	8°74974	225	11°25026	9°99932	47
14	8°75130	223	8°75199	224	11°24801	9°99931	46
15	8°75353	222	8°75423	222	11°24577	9°99930	45
16	8°75575	220	8°75687	222	11°24355	9°99929	44
17	8°75795	220	8°75907	220	11°24133	9°99929	43
18	8°76015	219	8°76087	219	11°23913	9°99928	42
19	8°76234	217	8°76306	219	11°23694	9°99927	41
20	8°76451	216	8°76525	217	11°23475	9°99926	40
21	8°76667	216	8°76742	216	11°23258	9°99926	39
22	8°76883	214	8°76958	215	11°23042	9°99925	38
23	8°77097	213	8°77173	214	11°22827	9°99924	37
24	8°77310	212	8°77387	213	11°22613	9°99923	36
25	8°77522	211	8°77600	211	11°22400	9°99923	35
26	8°77733	210	8°77811	211	11°22189	9°99922	34
27	8°77943	209	8°78022	210	11°21978	9°99921	33
28	8°78152	208	8°78232	209	11°21768	9°99920	32
29	8°78360	208	8°78441	208	11°21559	9°99920	31
30	8°78568		8°78649		11°21351	9°99919	30
'	Co-line.	Cotang.	Tangent.	Diff.	Co-line.	Size.	'

[86 degrees.]

[3 degrees.]

'	Size.	Diff.	Tangent.	Diff.	Cotang.	Co-line.	'
30	8°8568	206	8°78859	206	11°21351	9°99919	30
31	8°85774	205	8°78859	205	11°21145	9°99918	29
32	8°85979	204	8°79061	205	11°20939	9°99917	28
33	8°85983	203	8°79266	204	11°20734	9°99917	27
34	8°85986	202	8°79470	203	11°20530	9°99916	26
35	8°85988	201	8°79673	202	11°20327	9°99915	25
36	8°85989	201	8°80076	201	11°20125	9°99914	24
37	8°85990	199	8°80277	199	11°19924	9°99913	23
38	8°85982	199	8°80476	199	11°19721	9°99913	22
39	8°85988	197	8°80674	198	11°19524	9°99912	21
40	8°85985	197	8°80872	196	11°19326	9°99911	20
41	8°85982	196	8°81068	196	11°19128	9°99910	19
42	8°85978	195	8°81264	195	11°18932	9°99909	18
43	8°85973	194	8°81459	194	11°18736	9°99909	17
44	8°85960	192	8°81653	193	11°18541	9°99908	16
45	8°85952	192	8°81846	192	11°18347	9°99907	15
46	8°85944	192	8°82038	192	11°18154	9°99906	14
47	8°85944	190	8°82230	190	11°17962	9°99905	13
48	8°85944	189	8°82420	190	11°17770	9°99904	12
49	8°85944	188	8°82610	189	11°17580	9°99904	11
50	8°85944	188	8°82800	188	11°17390	9°99903	10
51	8°85944	187	8°82989	188	11°17201	9°99902	9
52	8°85944	187	8°83175	186	11°17013	9°99901	8
53	8°85944	186	8°83361	186	11°16825	9°99900	7
54	8°85944	185	8°83547	185	11°16639	9°99899	6
55	8°85944	184	8°83732	184	11°16453	9°99898	5
56	8°85944	183	8°83916	184	11°16268	9°99898	4
57	8°85944	183	8°84100	184	11°16084	9°99897	3
58	8°85944	181	8°84282	182	11°15900	9°99896	2
59	8°85944	181	8°84464	182	11°15718	9°99895	1
60	8°85944				11°15536	9°99894	0
'	Co-line.	Cotang.	Tangent.	Diff.	Co-line.	Size.	'

[86 degrees.]

**[4 degrees.]**

[illegible]

**[85 degrees.]**

**[4 degrees.]**

[illegible]

[85 degrees.]

[5 degrees.]

'	Dist.	Tangent.	Dist.	Cotang.	Co-sine.	'
0	8'94030	8'94195	145	11'05805	9'99834	60
1	8'94174	8'94348	146	11'05606	9'99833	59
2	8'94317	8'94485	147	11'05515	9'99832	58
3	8'94461	8'94630	148	11'05370	9'99831	57
4	8'94603	8'94773	149	11'05227	9'99830	56
5	8'94746	8'94917	150	11'05083	9'99829	55
6	8'94887	8'95060	151	11'04940	9'99828	54
7	8'95029	8'95202	152	11'04798	9'99827	53
8	8'95170	8'95344	153	11'04656	9'99825	52
9	8'95310	8'95486	154	11'04514	9'99824	51
10	8'95450	8'95627	155	11'04373	9'99823	50
11	8'95589	8'95767	156	11'04233	9'99822	49
12	8'95728	8'95908	157	11'04092	9'99821	48
13	8'95867	8'96047	158	11'03953	9'99820	47
14	8'96005	8'96187	159	11'03813	9'99819	46
15	8'96143	8'96325	160	11'03675	9'99817	45
16	8'96280	8'96464	161	11'03536	9'99816	44
17	8'96417	8'96602	162	11'03398	9'99815	43
18	8'96553	8'96739	163	11'03261	9'99814	42
19	8'96689	8'96877	164	11'03123	9'99813	41
20	8'96825	8'97013	165	11'02987	9'99812	40
21	8'96960	8'97150	166	11'02850	9'99810	39
22	8'97095	8'97285	167	11'02715	9'99809	38
23	8'97229	8'97421	168	11'02579	9'99808	37
24	8'97363	8'97556	169	11'02444	9'99807	36
25	8'97496	8'97691	170	11'02309	9'99806	35
26	8'97629	8'97825	171	11'02175	9'99804	34
27	8'97762	8'97959	172	11'02041	9'99803	33
28	8'97894	8'98092	173	11'01908	9'99802	32
29	8'98026	8'98225	174	11'01775	9'99801	31
30	8'98157	8'98358	175	11'01642	9'99800	30
'	Co-sine.	Cotang.	Tangent.	Dist.	Co-sine.	'

[84 degrees.]

[5 degrees.]

'	Dist.	Tangent.	Dist.	Cotang.	Co-sine.	'
0	8'98157	8'98358	132	11'01642	9'99800	30
1	8'98288	8'98490	133	11'01510	9'99798	29
2	8'98419	8'98622	134	11'01378	9'99797	28
3	8'98549	8'98753	135	11'01247	9'99796	27
4	8'98679	8'98884	136	11'01116	9'99795	26
5	8'98808	8'99015	137	11'00985	9'99793	25
6	8'98937	8'99145	138	11'00855	9'99792	24
7	8'99066	8'99275	139	11'00725	9'99791	23
8	8'99194	8'99405	140	11'00595	9'99790	22
9	8'99322	8'99534	141	11'00466	9'99788	21
10	8'99450	8'99662	142	11'00338	9'99787	20
11	8'99577	8'99791	143	11'00209	9'99786	19
12	8'99704	8'99919	144	11'00081	9'99785	18
13	8'99830	9'00046	145	10'99954	9'99783	17
14	8'99956	9'00174	146	10'99826	9'99782	16
15	9'00082	9'00301	147	10'99699	9'99781	15
16	9'00207	9'00427	148	10'99573	9'99780	14
17	9'00332	9'00553	149	10'99447	9'99778	13
18	9'00456	9'00679	150	10'99321	9'99777	12
19	9'00581	9'00805	151	10'99195	9'99776	11
20	9'00704	9'00930	152	10'99070	9'99775	10
21	9'00828	9'01055	153	10'98945	9'99773	9
22	9'00951	9'01179	154	10'98821	9'99772	8
23	9'01074	9'01303	155	10'98697	9'99771	7
24	9'01196	9'01427	156	10'98573	9'99769	6
25	9'01318	9'01551	157	10'98450	9'99768	5
26	9'01440	9'01673	158	10'98327	9'99767	4
27	9'01561	9'01796	159	10'98204	9'99765	3
28	9'01683	9'01918	160	10'98082	9'99764	2
29	9'01803	9'02040	161	10'97960	9'99763	1
30	9'01923	9'02162	162	10'97838	9'99761	0
'	Co-sine.	Cotang.	Tangent.	Dist.	Co-sine.	'

[84 degrees.]

**[6 degrees.]**

		Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	
0	0° 10' 13	120	9° 02' 16	120	121	10° 9' 38	9° 9' 761	60
1	0° 20' 43	120	9° 02' 28	120	121	10° 9' 717	9° 9' 660	59
2	0° 31' 03	120	9° 02' 40	120	121	10° 9' 756	9° 9' 759	58
3	0° 42' 3	120	9° 02' 52	120	121	10° 9' 745	9° 9' 757	57
4	0° 54' 02	119	9° 03' 04	119	120	10° 9' 735	9° 9' 756	56
5	0° 65' 50	119	9° 03' 16	119	119	10° 9' 724	9° 9' 755	55
6	0° 77' 39	118	9° 02' 88	119	120	10° 9' 715	9° 9' 753	54
7	0° 89' 27	118	9° 03' 00	119	120	10° 9' 695	9° 9' 752	53
8	0° 101' 14	118	9° 03' 12	118	119	10° 9' 687	9° 9' 751	52
9	0° 113' 02	117	9° 03' 24	118	120	10° 9' 678	9° 9' 749	51
10	0° 124' 50	117	9° 03' 36	117	120	10° 9' 669	9° 9' 747	50
11	0° 136' 38	116	9° 03' 48	117	120	10° 9' 651	9° 9' 744	49
12	0° 148' 26	116	9° 03' 59	117	120	10° 9' 640	9° 9' 745	48
13	0° 159' 14	116	9° 04' 11	118	120	10° 9' 628	9° 9' 744	47
14	0° 170' 02	116	9° 04' 23	116	120	10° 9' 616	9° 9' 744	46
15	0° 180' 50	115	9° 04' 34	117	120	10° 9' 605	9° 9' 741	45
16	0° 191' 38	115	9° 04' 45	117	120	10° 9' 593	9° 9' 740	44
17	0° 202' 26	114	9° 04' 57	116	120	10° 9' 581	9° 9' 738	43
18	0° 213' 14	115	9° 05' 08	115	120	10° 9' 570	9° 9' 737	42
19	0° 224' 02	115	9° 05' 19	115	120	10° 9' 558	9° 9' 736	41
20	0° 234' 50	114	9° 05' 30	115	120	10° 9' 547	9° 9' 734	40
21	0° 245' 38	114	9° 05' 41	115	120	10° 9' 535	9° 9' 733	39
22	0° 256' 26	113	9° 05' 52	115	120	10° 9' 524	9° 9' 731	38
23	0° 267' 14	112	9° 06' 03	115	120	10° 9' 512	9° 9' 730	37
24	0° 278' 02	112	9° 06' 14	114	120	10° 9' 501	9° 9' 728	36
25	0° 288' 50	112	9° 06' 25	114	120	10° 9' 489	9° 9' 727	35
26	0° 299' 38	112	9° 06' 36	114	120	10° 9' 478	9° 9' 726	34
27	0° 310' 26	111	9° 06' 47	114	120	10° 9' 467	9° 9' 724	33
28	0° 321' 14	111	9° 06' 58	112	120	10° 9' 455	9° 9' 723	32
29	0° 332' 02	111	9° 07' 09	112	120	10° 9' 444	9° 9' 721	31
30	0° 342' 50	111	9° 07' 20	111	120	10° 9' 433	9° 9' 720	30
31	0° 353' 38	111	9° 07' 31	111	120	10° 9' 422	9° 9' 719	29
32	0° 364' 26	110	9° 07' 42	111	120	10° 9' 411	9° 9' 718	28
33	0° 375' 14	110	9° 07' 53	110	120	10° 9' 400	9° 9' 717	27
34	0° 386' 02	110	9° 08' 04	110	120	10° 9' 389	9° 9' 716	26
35	0° 396' 50	110	9° 08' 15	110	120	10° 9' 378	9° 9' 715	25
36	0° 407' 38	109	9° 08' 26	110	120	10° 9' 367	9° 9' 714	24
37	0° 418' 26	109	9° 08' 37	109	120	10° 9' 356	9° 9' 713	23
38	0° 429' 14	109	9° 08' 48	109	120	10° 9' 345	9° 9' 712	22
39	0° 440' 02	108	9° 08' 59	109	120	10° 9' 334	9° 9' 711	21
40	0° 450' 50	108	9° 09' 10	108	120	10° 9' 323	9° 9' 710	20
41	0° 461' 38	107	9° 09' 21	108	120	10° 9' 312	9° 9' 709	19
42	0° 472' 26	107	9° 09' 32	107	120	10° 9' 301	9° 9' 708	18
43	0° 483' 14	107	9° 09' 43	107	120	10° 9' 290	9° 9' 707	17
44	0° 494' 02	106	9° 09' 54	107	120	10° 9' 279	9° 9' 706	16
45	0° 504' 50	106	9° 10' 05	106	120	10° 9' 268	9° 9' 705	15
46	0° 515' 38	105	9° 10' 16	106	120	10° 9' 257	9° 9' 704	14
47	0° 526' 26	105	9° 10' 27	105	120	10° 9' 246	9° 9' 703	13
48	0° 537' 14	105	9° 10' 38	105	120	10° 9' 235	9° 9' 702	12
49	0° 548' 02	104	9° 10' 49	105	120	10° 9' 224	9° 9' 701	11
50	0° 558' 50	104	9° 10' 60	104	120	10° 9' 213	9° 9' 700	10
51	0° 569' 38	104	9° 10' 71	104	120	10° 9' 202	9° 9' 699	9
52	0° 580' 26	103	9° 10' 82	104	120	10° 9' 191	9° 9' 698	8
53	0° 591' 14	103	9° 10' 93	103	120	10° 9' 180	9° 9' 697	7
54	0° 602' 02	103	9° 10' 104	103	120	10° 9' 169	9° 9' 696	6
55	0° 612' 50	102	9° 10' 115	103	120	10° 9' 158	9° 9' 695	5
56	0° 623' 38	102	9° 10' 126	102	120	10° 9' 147	9° 9' 694	4
57	0° 634' 26	102	9° 10' 137	102	120	10° 9' 136	9° 9' 693	3
58	0° 645' 14	101	9° 10' 148	102	120	10° 9' 125	9° 9' 692	2
59	0° 656' 02	101	9° 10' 159	101	120	10° 9' 114	9° 9' 691	1
60	0° 666' 50	101	9° 10' 170	101	120	10° 9' 103	9° 9' 690	0

**[83 degrees.]**

[83 degrees.]

[6 degrees.]

°	Slms.	Diff.	Tangent.	Collang.	Collang.	Collang.	°
30	9°51'36	110	9°51'66	112	10°94'34	9°97'20	30
31	9°51'49	111	9°51'78	112	10°94'22	9°97'18	29
32	9°51'56	110	9°51'89	112	10°94'10	9°97'17	28
33	9°51'17	110	9°51'31	111	10°93'58	9°97'16	27
34	9°51'37	109	9°51'46	111	10°93'87	9°97'14	26
35	9°51'53	109	9°51'62	111	10°93'76	9°97'13	25
36	9°52'06	109	9°51'35	110	10°93'65	9°97'11	24
37	9°51'55	109	9°51'45	111	10°93'55	9°97'10	23
38	9°51'44	108	9°51'56	110	10°93'44	9°97'08	22
39	9°51'37	109	9°51'66	109	10°93'34	9°97'07	21
40	9°51'28	108	9°51'75	109	10°93'23	9°97'05	20
41	9°51'19	107	9°51'85	109	10°93'15	9°97'04	19
42	9°51'06	107	9°51'94	108	10°93'06	9°97'02	18
43	9°50'54	106	9°52'02	108	10°92'57	9°97'01	17
44	9°50'41	107	9°52'11	109	10°92'49	9°96'59	16
45	9°50'28	106	9°52'20	108	10°92'40	9°96'58	15
46	9°50'14	105	9°52'28	108	10°92'32	9°96'56	14
47	9°50'03	106	9°52'36	107	10°92'24	9°96'55	13
48	9°50'37	105	9°52'43	108	10°92'17	9°96'53	12
49	9°50'44	106	9°52'51	107	10°92'10	9°96'52	11
50	9°50'54	105	9°52'58	106	10°92'04	9°96'50	10
51	9°50'53	105	9°52'59	107	10°92'02	9°96'49	9
52	9°50'58	105	9°53'01	106	10°92'00	9°96'48	8
53	9°50'53	105	9°53'06	106	10°91'58	9°96'46	7
54	9°50'58	104	9°53'09	106	10°91'57	9°96'44	6
55	9°50'57	104	9°53'10	105	10°91'56	9°96'43	5
56	9°50'58	104	9°53'11	105	10°91'55	9°96'42	4
57	9°50'58	103	9°53'12	105	10°91'54	9°96'40	3
58	9°50'58	103	9°53'13	105	10°91'53	9°96'39	2
59	9°50'58	103	9°53'14	104	10°91'52	9°96'38	1
60	9°50'58	103	9°53'15	104	10°91'51	9°96'37	0
			Collang.		Tangent.	Slms.	

[83 degrees.]

[ 83 degrees.]

[7 degrees.]

	Dist.	Tangent.	Coang.	Co-line.	
0	9°05'59	9°08'14	10°9'086	9°99'75	60
1	9°08'64	9°09'19	10°9'081	9°99'74	59
2	9°08'795	9°09'123	10°9'0877	9°99'674	58
3	9°08'897	9°09'217	10°9'0773	9°99'670	57
4	9°08'999	9°09'310	10°9'0678	9°99'669	56
5	9°09'101	9°09'414	10°9'0566	9°99'667	55
6	9°09'202	9°09'517	10°9'0451	9°99'666	54
7	9°09'304	9°09'640	10°9'0360	9°99'664	53
8	9°09'405	9°09'744	10°9'0258	9°99'663	52
9	9°09'506	9°09'845	10°9'0155	9°99'661	51
10	9°09'606	9°09'947	10°9'0033	9°99'659	50
11	9°09'707	9°10'049	10°8'9931	9°99'658	49
12	9°09'807	9°10'150	10°8'9850	9°99'656	48
13	9°09'907	9°10'252	10°8'9748	9°99'655	47
14	9°10'006	9°10'353	10°8'9647	9°99'653	46
15	9°10'106	9°10'454	10°8'9546	9°99'651	45
16	9°10'205	9°10'555	10°8'9445	9°99'650	44
17	9°10'304	9°10'656	10°8'9344	9°99'648	43
18	9°10'402	9°10'756	10°8'9244	9°99'647	42
19	9°10'501	9°10'856	10°8'9144	9°99'645	41
20	9°10'599	9°10'956	10°8'9044	9°99'643	40
21	9°10'697	9°11'056	10°8'8944	9°99'642	39
22	9°10'795	9°11'155	10°8'8845	9°99'640	38
23	9°10'893	9°11'254	10°8'8746	9°99'638	37
24	9°10'990	9°11'353	10°8'8647	9°99'637	36
25	9°11'087	9°11'452	10°8'8548	9°99'635	35
26	9°11'184	9°11'551	10°8'8449	9°99'633	34
27	9°11'281	9°11'649	10°8'8351	9°99'632	33
28	9°11'377	9°11'747	10°8'8253	9°99'630	32
29	9°11'474	9°11'845	10°8'8155	9°99'629	31
30	9°11'570	9°11'943	10°8'8057	9°99'627	30
	Co-line.	Coang.	Tangent.	Co-line.	

[82 degrees.]

[7 degrees.]

	Dist.	Tangent.	Coang.	Co-line.	
30	9°11'70	9°11'943	10°8'8057	9°99'627	30
31	9°11'866	9°12'040	10°8'7960	9°99'625	29
32	9°11'961	9°12'138	10°8'7862	9°99'624	28
33	9°11'857	9°12'235	10°8'7765	9°99'622	27
34	9°11'952	9°12'332	10°8'7668	9°99'620	26
35	9°12'047	9°12'428	10°8'7572	9°99'618	25
36	9°12'142	9°12'525	10°8'7475	9°99'617	24
37	9°12'236	9°12'621	10°8'7379	9°99'615	23
38	9°12'331	9°12'717	10°8'7283	9°99'613	22
39	9°12'425	9°12'813	10°8'7187	9°99'612	21
40	9°12'519	9°12'909	10°8'7091	9°99'610	20
41	9°12'612	9°13'004	10°8'6996	9°99'608	19
42	9°12'706	9°13'099	10°8'6901	9°99'607	18
43	9°12'799	9°13'194	10°8'6806	9°99'605	17
44	9°12'892	9°13'289	10°8'6711	9°99'603	16
45	9°12'985	9°13'384	10°8'6616	9°99'601	15
46	9°13'078	9°13'478	10°8'6522	9°99'600	14
47	9°13'171	9°13'573	10°8'6427	9°99'598	13
48	9°13'263	9°13'667	10°8'6333	9°99'596	12
49	9°13'355	9°13'761	10°8'6239	9°99'595	11
50	9°13'447	9°13'854	10°8'6146	9°99'593	10
51	9°13'539	9°13'948	10°8'6052	9°99'591	9
52	9°13'630	9°14'041	10°8'5959	9°99'589	8
53	9°13'722	9°14'134	10°8'5866	9°99'588	7
54	9°13'813	9°14'227	10°8'5773	9°99'586	6
55	9°13'904	9°14'320	10°8'5680	9°99'584	5
56	9°13'994	9°14'412	10°8'5588	9°99'582	4
57	9°14'085	9°14'504	10°8'5496	9°99'581	3
58	9°14'175	9°14'597	10°8'5403	9°99'579	2
59	9°14'266	9°14'688	10°8'5312	9°99'577	1
60	9°14'356	9°14'780	10°8'5220	9°99'575	0
	Co-line.	Coang.	Tangent.	Co-line.	

[82 degrees.]

[8 degrees.]

'	Secs.	D.M.	Tangent.	D.M.	Cotang.	Cosine.	D.	'
30	9° 16' 57.0	85	9° 17' 45.0	86	10° 8' 21.50	9° 99' 54.0	30	'
31	9° 17' 05.5	84	9° 17' 55.5	85	10° 8' 24.64	9° 99' 51.8	29	'
32	9° 17' 19.9	84	9° 17' 62.2	86	10° 8' 23.78	9° 99' 51.7	28	'
33	9° 17' 22.3	84	9° 17' 64.8	86	10° 8' 22.92	9° 99' 51.5	27	'
34	9° 17' 30.7	84	9° 17' 70.8	86	10° 8' 22.06	9° 99' 51.3	26	'
35	9° 17' 39.1	83	9° 17' 78.0	85	10° 8' 21.20	9° 99' 51.1	25	'
36	9° 17' 47.4	84	9° 17' 85.5	86	10° 8' 20.35	9° 99' 50.9	24	'
37	9° 17' 55.8	83	9° 18' 01.1	85	10° 8' 19.49	9° 99' 50.7	23	'
38	9° 17' 64.1	83	9° 18' 13.6	85	10° 8' 18.64	9° 99' 50.5	22	'
39	9° 17' 72.4	83	9° 18' 21.1	85	10° 8' 17.79	9° 99' 50.3	21	'
40	9° 17' 80.7	83	9° 18' 30.6	85	10° 8' 16.94	9° 99' 50.1	20	'
41	9° 17' 89.0	83	9° 18' 39.1	84	10° 8' 16.09	9° 99' 49.9	19	'
42	9° 17' 97.3	82	9° 18' 47.5	85	10° 8' 15.25	9° 99' 49.7	18	'
43	9° 18' 05.5	82	9° 18' 56.0	84	10° 8' 14.40	9° 99' 49.5	17	'
44	9° 18' 13.7	83	9° 18' 64.4	84	10° 8' 13.56	9° 99' 49.4	16	'
45	9° 18' 22.0	82	9° 18' 72.8	84	10° 8' 12.72	9° 99' 49.2	15	'
46	9° 18' 30.2	81	9° 18' 81.2	84	10° 8' 11.88	9° 99' 49.0	14	'
47	9° 18' 38.3	82	9° 18' 89.6	83	10° 8' 11.04	9° 99' 48.8	13	'
48	9° 18' 46.5	82	9° 18' 97.9	84	10° 8' 10.21	9° 99' 48.6	12	'
49	9° 18' 54.7	81	9° 19' 06.3	83	10° 8' 9.37	9° 99' 48.4	11	'
50	9° 18' 62.8	81	9° 19' 14.6	83	10° 8' 8.54	9° 99' 48.2	10	'
51	9° 18' 70.9	81	9° 19' 22.9	83	10° 8' 7.71	9° 99' 48.0	9	'
52	9° 18' 79.0	81	9° 19' 31.2	83	10° 8' 6.88	9° 99' 47.8	8	'
53	9° 18' 87.1	81	9° 19' 39.5	83	10° 8' 6.06	9° 99' 47.6	7	'
54	9° 18' 95.2	81	9° 19' 47.8	83	10° 8' 5.22	9° 99' 47.4	6	'
55	9° 19' 03.3	80	9° 19' 56.1	82	10° 8' 4.39	9° 99' 47.2	5	'
56	9° 19' 11.3	80	9° 20' 04.3	82	10° 8' 3.57	9° 99' 47.0	4	'
57	9° 19' 19.3	80	9° 20' 12.5	82	10° 8' 2.75	9° 99' 46.8	3	'
58	9° 19' 27.3	80	9° 20' 20.7	82	10° 8' 1.93	9° 99' 46.6	2	'
59	9° 19' 35.3	80	9° 20' 28.9	82	10° 8' 1.11	9° 99' 46.4	1	'
60	9° 19' 43.3		9° 20' 37.1		10° 8' 0.29	9° 99' 46.2	0	'
'	Cosine.		Cotang.		Tangent.	Sine.	'	

[81 degrees.]

[8 degrees.]

'	Secs.	D.M.	Tangent.	D.M.	Cotang.	Cosine.	D.	'
0	9° 14' 35.6	89	9° 14' 28.0	91	10° 8' 52.20	9° 99' 57.5	1	59
1	9° 14' 44.5	90	9° 14' 37.2	91	10° 8' 51.28	9° 99' 57.4	2	58
2	9° 14' 53.5	89	9° 14' 46.3	91	10° 8' 50.37	9° 99' 57.2	3	57
3	9° 14' 62.4	90	9° 15' 04.4	91	10° 8' 49.46	9° 99' 57.0	4	56
4	9° 14' 71.4	89	9° 15' 14.5	91	10° 8' 48.55	9° 99' 56.8	5	55
5	9° 14' 80.3	88	9° 15' 23.5	91	10° 8' 47.64	9° 99' 56.6	6	54
6	9° 14' 89.1	89	9° 15' 32.7	90	10° 8' 46.73	9° 99' 56.5	7	53
7	9° 14' 98.0	88	9° 15' 41.7	91	10° 8' 45.83	9° 99' 56.3	8	52
8	9° 15' 06.9	89	9° 15' 50.8	90	10° 8' 44.92	9° 99' 56.1	9	51
9	9° 15' 15.7	88	9° 15' 59.8	90	10° 8' 44.02	9° 99' 55.9	10	50
10	9° 15' 24.5	88	9° 16' 08.8	89	10° 8' 43.12	9° 99' 55.7	11	49
11	9° 15' 33.3	88	9° 16' 17.7	90	10° 8' 42.23	9° 99' 55.6	12	48
12	9° 15' 42.1	87	9° 16' 26.7	89	10° 8' 41.33	9° 99' 55.4	13	47
13	9° 15' 50.8	88	9° 16' 35.6	90	10° 8' 40.44	9° 99' 55.2	14	46
14	9° 15' 59.6	87	9° 16' 44.6	89	10° 8' 39.54	9° 99' 55.0	15	45
15	9° 16' 08.3	87	9° 16' 53.5	89	10° 8' 38.65	9° 99' 54.8	16	44
16	9° 16' 17.0	86	9° 17' 02.4	88	10° 8' 37.76	9° 99' 54.6	17	43
17	9° 16' 25.7	87	9° 17' 11.2	89	10° 8' 36.88	9° 99' 54.5	18	42
18	9° 16' 34.4	86	9° 17' 20.1	88	10° 8' 35.99	9° 99' 54.3	19	41
19	9° 16' 43.0	86	9° 17' 29.0	88	10° 8' 35.11	9° 99' 54.1	20	40
20	9° 16' 51.6	87	9° 17' 37.8	87	10° 8' 34.23	9° 99' 53.9	21	39
21	9° 17' 00.3	86	9° 17' 46.6	88	10° 8' 33.35	9° 99' 53.7	22	38
22	9° 17' 08.9	85	9° 17' 55.4	88	10° 8' 32.47	9° 99' 53.5	23	37
23	9° 17' 17.6	86	9° 18' 04.1	87	10° 8' 31.59	9° 99' 53.3	24	36
24	9° 17' 26.3	85	9° 18' 12.8	88	10° 8' 30.72	9° 99' 53.2	25	35
25	9° 17' 35.0	86	9° 18' 21.5	87	10° 8' 29.84	9° 99' 53.0	26	34
26	9° 17' 43.7	85	9° 18' 30.2	87	10° 8' 28.97	9° 99' 52.8	27	33
27	9° 17' 52.4	85	9° 18' 38.9	87	10° 8' 28.10	9° 99' 52.6	28	32
28	9° 18' 01.1	84	9° 18' 47.6	86	10° 8' 27.23	9° 99' 52.4	29	31
29	9° 18' 09.8	84	9° 18' 56.3	87	10° 8' 26.37	9° 99' 52.2	30	30
30	9° 18' 18.5		9° 19' 05.0		10° 8' 25.50	9° 99' 52.0	31	29
'	Cosine.		Cotang.		Tangent.	Sine.	'	

[81 degrees.]

[9 degrees.]

.	Decl.	Tangent.	Dif.	Cotang.	Decl.	.
0	9° 19' 433	80	9° 19' 777	10° 8' 029	9° 19' 461	60
1	9° 19' 513	79	9° 20' 053	10° 7' 997	9° 19' 460	59
2	9° 19' 592	78	9° 20' 134	10° 7' 986	9° 19' 458	58
3	9° 19' 672	77	9° 20' 216	10° 7' 974	9° 19' 456	57
4	9° 19' 751	76	9° 20' 297	10° 7' 973	9° 19' 454	56
5	9° 19' 830	75	9° 20' 378	10° 7' 962	9° 19' 452	55
6	9° 19' 909	74	9° 20' 459	10° 7' 951	9° 19' 450	54
7	9° 19' 988	73	9° 20' 540	10° 7' 940	9° 19' 448	53
8	9° 20' 067	72	9° 21' 021	10° 7' 939	9° 19' 446	52
9	9° 20' 145	71	9° 21' 102	10° 7' 929	9° 19' 444	51
10	9° 20' 223	70	9° 21' 183	10° 7' 918	9° 19' 442	50
11	9° 20' 302	69	9° 21' 264	10° 7' 913	9° 19' 440	49
12	9° 20' 380	68	9° 21' 345	10° 7' 903	9° 19' 438	48
13	9° 20' 458	67	9° 21' 426	10° 7' 892	9° 19' 436	47
14	9° 20' 535	66	9° 21' 507	10° 7' 881	9° 19' 434	46
15	9° 20' 613	65	9° 21' 588	10° 7' 870	9° 19' 432	45
16	9° 20' 691	64	9° 22' 069	10° 7' 859	9° 19' 430	44
17	9° 20' 768	63	9° 22' 150	10° 7' 848	9° 19' 428	43
18	9° 20' 845	62	9° 22' 231	10° 7' 837	9° 19' 426	42
19	9° 20' 922	61	9° 22' 312	10° 7' 826	9° 19' 424	41
20	9° 21' 000	60	9° 22' 393	10° 7' 815	9° 19' 422	40
21	9° 21' 076	59	9° 22' 474	10° 7' 804	9° 19' 420	39
22	9° 21' 153	58	9° 22' 555	10° 7' 793	9° 19' 418	38
23	9° 21' 230	57	9° 23' 036	10° 7' 782	9° 19' 416	37
24	9° 21' 306	56	9° 23' 117	10° 7' 771	9° 19' 414	36
25	9° 21' 383	55	9° 23' 198	10° 7' 760	9° 19' 412	35
26	9° 21' 459	54	9° 23' 279	10° 7' 749	9° 19' 410	34
27	9° 21' 534	53	9° 23' 360	10° 7' 738	9° 19' 408	33
28	9° 21' 610	52	9° 23' 441	10° 7' 727	9° 19' 406	32
29	9° 21' 685	51	9° 23' 522	10° 7' 716	9° 19' 404	31
30	9° 21' 761	50	9° 24' 003	10° 7' 705	9° 19' 402	30

[80 degrees.]

[9 degrees.]

.	Decl.	Tangent.	Dif.	Cotang.	Decl.	.
30	9° 21' 836	75	9° 24' 084	10° 7' 693	9° 21' 800	30
31	9° 21' 913	74	9° 24' 165	10° 7' 682	9° 21' 799	29
32	9° 21' 990	73	9° 24' 246	10° 7' 671	9° 21' 798	28
33	9° 22' 067	72	9° 24' 327	10° 7' 660	9° 21' 797	27
34	9° 22' 144	71	9° 24' 408	10° 7' 649	9° 21' 796	26
35	9° 22' 221	70	9° 24' 489	10° 7' 638	9° 21' 795	25
36	9° 22' 298	69	9° 24' 570	10° 7' 627	9° 21' 794	24
37	9° 22' 375	68	9° 25' 051	10° 7' 616	9° 21' 793	23
38	9° 22' 452	67	9° 25' 132	10° 7' 605	9° 21' 792	22
39	9° 22' 529	66	9° 25' 213	10° 7' 594	9° 21' 791	21
40	9° 23' 006	65	9° 25' 294	10° 7' 583	9° 21' 790	20
41	9° 23' 083	64	9° 25' 375	10° 7' 572	9° 21' 789	19
42	9° 23' 160	63	9° 25' 456	10° 7' 561	9° 21' 788	18
43	9° 23' 237	62	9° 25' 537	10° 7' 550	9° 21' 787	17
44	9° 23' 314	61	9° 26' 018	10° 7' 539	9° 21' 786	16
45	9° 23' 391	60	9° 26' 099	10° 7' 528	9° 21' 785	15
46	9° 23' 468	59	9° 26' 180	10° 7' 517	9° 21' 784	14
47	9° 23' 545	58	9° 26' 261	10° 7' 506	9° 21' 783	13
48	9° 24' 022	57	9° 26' 342	10° 7' 495	9° 21' 782	12
49	9° 24' 100	56	9° 26' 423	10° 7' 484	9° 21' 781	11
50	9° 24' 177	55	9° 26' 504	10° 7' 473	9° 21' 780	10
51	9° 24' 254	54	9° 26' 585	10° 7' 462	9° 21' 779	9
52	9° 24' 331	53	9° 27' 066	10° 7' 451	9° 21' 778	8
53	9° 24' 408	52	9° 27' 147	10° 7' 440	9° 21' 777	7
54	9° 24' 485	51	9° 27' 228	10° 7' 429	9° 21' 776	6
55	9° 24' 562	50	9° 27' 309	10° 7' 418	9° 21' 775	5
56	9° 25' 039	49	9° 27' 390	10° 7' 407	9° 21' 774	4
57	9° 25' 116	48	9° 27' 471	10° 7' 396	9° 21' 773	3
58	9° 25' 193	47	9° 27' 552	10° 7' 385	9° 21' 772	2
59	9° 25' 270	46	9° 28' 033	10° 7' 374	9° 21' 771	1
60	9° 25' 347	45	9° 28' 114	10° 7' 363	9° 21' 770	0

[80 degrees.]



[10 degrees.]

	Ship.	Dist.	Tangent.	Dist.	Course.	D.	
0	9°23'07	72	9°46'52	74	10°7'53'68	9°59'33	60
1	9°24'09	72	9°47'06	74	10°7'55'94	9°59'33	59
2	9°24'10	71	9°47'19	74	10°7'52'21	9°59'33	58
3	9°24'18	71	9°48'51	73	10°7'51'47	9°59'32	57
4	9°24'53	71	9°49'58	74	10°7'50'78	9°59'32	56
5	9°24'53	71	9°50'00	73	10°7'50'00	9°59'34	55
6	9°24'39	71	9°50'71	73	10°7'49'37	9°59'32	54
7	9°24'46	70	9°51'46	73	10°7'48'54	9°59'31	53
8	9°24'53	71	9°52'19	73	10°7'47'81	9°59'31	52
9	9°24'07	70	9°53'29	73	10°7'47'08	9°59'31	51
10	9°24'67	71	9°53'65	72	10°7'46'35	9°59'31	50
11	9°24'48	70	9°54'37	73	10°7'45'03	9°59'31	49
12	9°24'18	70	9°55'10	72	10°7'44'00	9°59'30	48
13	9°24'88	70	9°55'82	73	10°7'44'18	9°59'30	47
14	9°24'98	70	9°55'55	72	10°7'43'45	9°59'30	46
15	9°25'02	70	9°57'27	72	10°7'43'71	9°59'30	45
16	9°25'08	70	9°57'09	72	10°7'43'01	9°59'29	44
17	9°25'16	69	9°57'57	72	10°7'42'29	9°59'29	43
18	9°25'37	70	9°59'43	72	10°7'40'57	9°59'29	42
19	9°25'07	69	9°56'15	71	10°7'39'85	9°59'28	41
20	9°25'37	69	9°56'08	72	10°7'39'14	9°59'28	40
21	9°25'44	69	9°56'18	72	10°7'38'42	9°59'28	39
22	9°25'14	69	9°56'15	71	10°7'37'71	9°59'28	38
23	9°25'83	69	9°56'30	71	10°7'36'99	9°59'28	37
24	9°25'62	69	9°56'37	71	10°7'36'28	9°59'28	36
25	9°25'21	69	9°56'44	71	10°7'35'57	9°59'28	35
26	9°25'90	68	9°56'54	71	10°7'34'86	9°59'27	34
27	9°25'88	69	9°56'85	70	10°7'34'15	9°59'27	33
28	9°25'97	68	9°56'65	71	10°7'33'45	9°59'27	32
29	9°25'95	68	9°56'72	71	10°7'32'74	9°59'26	31
30	9°26'03		9°56'77		10°7'32'03	9°59'26	30
	Ship.	Dist.	Tangent.	Dist.	Course.	D.	

[79 degrees.]

	Ship.	Dist.	Tangent.	Dist.	Course.	D.	
30	9°26'03	68	9°26'77	70	10°7'32'03	9°59'26	30
31	9°26'13	68	9°26'86	70	10°7'31'33	9°59'26	29
32	9°26'19	68	9°26'93	71	10°7'30'63	9°59'26	28
33	9°26'67	68	9°27'08	71	10°7'29'92	9°59'26	27
34	9°26'78	68	9°27'08	70	10°7'29'22	9°59'26	26
35	9°26'40	67	9°27'14	70	10°7'28'52	9°59'25	25
36	9°26'70	68	9°27'28	70	10°7'27'82	9°59'25	24
37	9°26'53	67	9°27'28	69	10°7'27'12	9°59'25	23
38	9°26'60	67	9°27'37	70	10°7'26'43	9°59'24	22
39	9°26'72	67	9°27'42	70	10°7'25'73	9°59'24	21
40	9°26'79	67	9°27'49	70	10°7'25'04	9°59'24	20
41	9°26'86	67	9°27'56	69	10°7'24'34	9°59'24	19
42	9°26'87	67	9°27'53	69	10°7'23'65	9°59'23	18
43	9°26'94	67	9°27'70	69	10°7'22'96	9°59'23	17
44	9°27'00	66	9°27'77	69	10°7'22'27	9°59'23	16
45	9°27'07	67	9°27'84	69	10°7'21'58	9°59'23	15
46	9°27'14	66	9°27'91	69	10°7'20'89	9°59'22	14
47	9°27'20	67	9°27'98	69	10°7'20'20	9°59'22	13
48	9°27'73	66	9°28'09	68	10°7'19'51	9°59'22	12
49	9°27'39	66	9°28'17	69	10°7'18'83	9°59'21	11
50	9°27'40	66	9°28'18	68	10°7'18'14	9°59'21	10
51	9°27'47	66	9°28'24	68	10°7'17'46	9°59'21	9
52	9°27'53	65	9°28'32	68	10°7'16'77	9°59'21	8
53	9°27'59	66	9°28'39	68	10°7'16'09	9°59'21	7
54	9°27'68	66	9°28'45	68	10°7'15'41	9°59'20	6
55	9°27'74	65	9°28'52	68	10°7'14'73	9°59'20	5
56	9°27'79	65	9°28'59	67	10°7'14'05	9°59'20	4
57	9°27'84	66	9°28'66	68	10°7'13'38	9°59'20	3
58	9°27'90	65	9°28'73	68	10°7'12'70	9°59'20	2
59	9°27'95	65	9°28'78	67	10°7'12'02	9°59'19	1
60	9°28'00		9°28'86		10°7'11'35	9°59'19	0
	Ship.	Dist.	Tangent.	Dist.	Course.	D.	

[79 degrees.]

[11 degrees.]

°	'	Dist.	Tangent.	Diff.	Cotang.	Cosine.	D.
30	0	9°29566	62	9°30846	10°67544	9°99119	30
31	1	9°30028	62	9°30911	10°69085	9°99117	29
32	2	9°30090	61	9°30975	10°70602	9°99114	28
33	3	9°30151	61	9°31040	10°72104	9°99112	27
34	4	9°30213	62	9°31104	10°73596	9°99109	26
35	5	9°30275	61	9°31168	10°75073	9°99106	25
36	6	9°30336	62	9°31233	10°76535	9°99104	24
37	7	9°30398	61	9°31297	10°77982	9°99101	23
38	8	9°30459	62	9°31361	10°79415	9°99099	22
39	9	9°30521	61	9°31425	10°80834	9°99096	21
40	10	9°30582	61	9°31489	10°82239	9°99093	20
41	11	9°30643	61	9°31552	10°83631	9°99091	19
42	12	9°30704	61	9°31616	10°85010	9°99088	18
43	13	9°30765	61	9°31679	10°86377	9°99086	17
44	14	9°30826	61	9°31743	10°87732	9°99083	16
45	15	9°30887	60	9°31806	10°89075	9°99080	15
46	16	9°30947	61	9°31870	10°90406	9°99078	14
47	17	9°31008	60	9°31933	10°91725	9°99075	13
48	18	9°31068	61	9°31996	10°93033	9°99072	12
49	19	9°31129	60	9°32059	10°94330	9°99070	11
50	20	9°31189	61	9°32122	10°95616	9°99067	10
51	21	9°31250	60	9°32185	10°96891	9°99064	9
52	22	9°31310	60	9°32248	10°98155	9°99062	8
53	23	9°31370	62	9°32311	10°99408	9°99059	7
54	24	9°31430	60	9°32373	10°10052	9°99056	6
55	25	9°31490	59	9°32436	10°10195	9°99054	5
56	26	9°31549	60	9°32498	10°10337	9°99051	4
57	27	9°31609	60	9°32561	10°10479	9°99048	3
58	28	9°31669	59	9°32623	10°10620	9°99046	2
59	29	9°31728	59	9°32685	10°10760	9°99043	1
60	30	9°31788	60	9°32747	10°10900	9°99040	0
		Contin.	Cotang.	Tangent.	Sine.		

[78 degrees.]

[11 degrees.]

°	'	Dist.	Tangent.	Diff.	Cotang.	Cosine.	D.
0	0	9°28060	65	9°28865	10°71135	9°99195	60
1	1	9°28125	65	9°28933	10°72607	9°99190	59
2	2	9°28190	64	9°29000	10°74060	9°99185	58
3	3	9°28254	65	9°29067	10°75503	9°99180	57
4	4	9°28319	65	9°29134	10°76936	9°99175	56
5	5	9°28384	64	9°29201	10°78360	9°99170	55
6	6	9°28448	64	9°29268	10°79775	9°99165	54
7	7	9°28512	65	9°29334	10°81181	9°99160	53
8	8	9°28577	64	9°29402	10°82578	9°99155	52
9	9	9°28641	64	9°29468	10°83966	9°99150	51
10	10	9°28705	64	9°29535	10°85345	9°99145	50
11	11	9°28769	64	9°29601	10°86715	9°99140	49
12	12	9°28833	63	9°29668	10°88076	9°99135	48
13	13	9°28896	64	9°29734	10°89428	9°99130	47
14	14	9°28960	64	9°29800	10°90771	9°99125	46
15	15	9°29024	63	9°29866	10°92106	9°99120	45
16	16	9°29087	63	9°29932	10°93432	9°99115	44
17	17	9°29150	64	9°29998	10°94750	9°99110	43
18	18	9°29214	63	9°30064	10°96060	9°99105	42
19	19	9°29277	63	9°30130	10°97362	9°99100	41
20	20	9°29340	63	9°30195	10°98656	9°99095	40
21	21	9°29403	63	9°30261	10°99942	9°99090	39
22	22	9°29466	63	9°30326	10°10129	9°99085	38
23	23	9°29529	62	9°30391	10°10316	9°99080	37
24	24	9°29591	63	9°30457	10°10503	9°99075	36
25	25	9°29654	63	9°30522	10°10690	9°99070	35
26	26	9°29716	63	9°30587	10°10877	9°99065	34
27	27	9°29779	62	9°30652	10°11064	9°99060	33
28	28	9°29841	62	9°30717	10°11251	9°99055	32
29	29	9°29903	63	9°30782	10°11438	9°99050	31
30	30	9°29966	63	9°30846	10°11625	9°99045	30
		Contin.	Cotang.	Tangent.	Sine.		

[78 degrees.]

[12 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Co-line.	D.	
0	9° 31' 88	59	9° 32' 47	63	10° 6' 253	9° 99' 040	60	
1	9° 31' 847	60	9° 32' 810	62	10° 6' 7190	9° 99' 038	59	
2	9° 31' 907	61	9° 32' 872	61	10° 6' 7118	9° 99' 035	58	
3	9° 31' 966	59	9° 32' 933	62	10° 6' 7067	9° 99' 032	57	
4	9° 32' 025	58	9° 32' 995	62	10° 6' 7005	9° 99' 030	56	
5	9° 32' 084	57	9° 33' 057	62	10° 6' 6943	9° 99' 027	55	
6	9° 32' 143	56	9° 33' 119	61	10° 6' 6881	9° 99' 024	54	
7	9° 32' 202	55	9° 33' 180	62	10° 6' 6820	9° 99' 022	53	
8	9° 32' 261	54	9° 33' 242	61	10° 6' 6758	9° 99' 019	52	
9	9° 32' 319	53	9° 33' 303	62	10° 6' 6697	9° 99' 016	51	
10	9° 32' 378	52	9° 33' 365	61	10° 6' 6635	9° 99' 013	50	
11	9° 32' 437	51	9° 33' 426	61	10° 6' 6574	9° 99' 011	49	
12	9° 32' 495	50	9° 33' 487	61	10° 6' 6513	9° 99' 008	48	
13	9° 32' 553	49	9° 33' 548	61	10° 6' 6452	9° 99' 005	47	
14	9° 32' 612	48	9° 33' 609	61	10° 6' 6391	9° 99' 002	46	
15	9° 32' 670	47	9° 33' 670	61	10° 6' 6330	9° 99' 000	45	
16	9° 32' 728	46	9° 33' 731	61	10° 6' 6269	9° 98' 997	44	
17	9° 32' 786	45	9° 33' 792	61	10° 6' 6208	9° 98' 994	43	
18	9° 32' 844	44	9° 33' 853	60	10° 6' 6147	9° 98' 991	42	
19	9° 32' 902	43	9° 33' 913	61	10° 6' 6087	9° 98' 989	41	
20	9° 32' 960	42	9° 33' 974	60	10° 6' 6026	9° 98' 986	40	
21	9° 33' 018	41	9° 34' 034	61	10° 6' 5966	9° 98' 983	39	
22	9° 33' 075	40	9° 34' 095	60	10° 6' 5905	9° 98' 980	38	
23	9° 33' 133	39	9° 34' 155	60	10° 6' 5845	9° 98' 978	37	
24	9° 33' 190	38	9° 34' 215	61	10° 6' 5785	9° 98' 975	36	
25	9° 33' 248	37	9° 34' 276	60	10° 6' 5724	9° 98' 972	35	
26	9° 33' 305	36	9° 34' 336	60	10° 6' 5664	9° 98' 969	34	
27	9° 33' 362	35	9° 34' 396	60	10° 6' 5604	9° 98' 967	33	
28	9° 33' 420	34	9° 34' 456	60	10° 6' 5544	9° 98' 964	32	
29	9° 33' 477	33	9° 34' 516	60	10° 6' 5484	9° 98' 961	31	
30	9° 33' 534	32	9° 34' 576	60	10° 6' 5424	9° 98' 958	30	
	Co-line.	Cotang.	Tangent.	Sine.				

[77 degrees.]

[12 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Co-line.	D.	
31	9° 33' 591	31	9° 34' 576	59	10° 6' 5424	9° 98' 958	30	
32	9° 34' 048	30	9° 34' 635	58	10° 6' 5365	9° 98' 955	29	
33	9° 34' 105	29	9° 34' 695	60	10° 6' 5305	9° 98' 953	28	
34	9° 34' 162	28	9° 34' 755	59	10° 6' 5245	9° 98' 950	27	
35	9° 34' 219	27	9° 34' 814	58	10° 6' 5186	9° 98' 947	26	
36	9° 34' 276	26	9° 34' 874	59	10° 6' 5126	9° 98' 944	25	
37	9° 34' 333	25	9° 34' 933	58	10° 6' 5067	9° 98' 941	24	
38	9° 34' 390	24	9° 34' 992	59	10° 6' 5008	9° 98' 938	23	
39	9° 34' 447	23	9° 35' 051	60	10° 6' 4949	9° 98' 936	22	
40	9° 34' 504	22	9° 35' 111	59	10° 6' 4889	9° 98' 933	21	
41	9° 34' 561	21	9° 35' 170	58	10° 6' 4830	9° 98' 930	20	
42	9° 35' 018	20	9° 35' 229	59	10° 6' 4771	9° 98' 927	19	
43	9° 35' 075	19	9° 35' 288	58	10° 6' 4712	9° 98' 924	18	
44	9° 35' 132	18	9° 35' 347	59	10° 6' 4653	9° 98' 921	17	
45	9° 35' 189	17	9° 35' 405	58	10° 6' 4595	9° 98' 919	16	
46	9° 35' 246	16	9° 35' 464	59	10° 6' 4536	9° 98' 916	15	
47	9° 35' 303	15	9° 35' 523	58	10° 6' 4477	9° 98' 913	14	
48	9° 35' 360	14	9° 35' 581	59	10° 6' 4419	9° 98' 910	13	
49	9° 35' 417	13	9° 36' 040	58	10° 6' 4360	9° 98' 907	12	
50	9° 35' 474	12	9° 36' 098	59	10° 6' 4302	9° 98' 904	11	
51	9° 35' 531	11	9° 36' 157	58	10° 6' 4243	9° 98' 901	10	
52	9° 35' 588	10	9° 36' 215	59	10° 6' 4185	9° 98' 898	9	
53	9° 36' 045	9	9° 36' 274	58	10° 6' 4127	9° 98' 896	8	
54	9° 36' 102	8	9° 36' 332	59	10° 6' 4069	9° 98' 893	7	
55	9° 36' 159	7	9° 36' 391	58	10° 6' 4011	9° 98' 890	6	
56	9° 36' 216	6	9° 36' 450	59	10° 6' 3953	9° 98' 887	5	
57	9° 36' 273	5	9° 36' 508	58	10° 6' 3895	9° 98' 884	4	
58	9° 36' 330	4	9° 36' 567	59	10° 6' 3837	9° 98' 881	3	
59	9° 36' 387	3	9° 37' 025	58	10° 6' 3779	9° 98' 878	2	
60	9° 36' 444	2	9° 37' 084	59	10° 6' 3721	9° 98' 875	1	
61	9° 36' 501	1	9° 37' 142	58	10° 6' 3664	9° 98' 872	0	
	Co-line.	Cotang.	Tangent.	Sine.				

[77 degrees.]

[13 degrees.]

	Sine.	Dist.	Tangent.	Cotang.	Co-line.	D.	
0	9° 33' 09	54	9° 36' 16	10° 6' 3664	9° 88' 72	3	60
1	9° 33' 46	55	9° 36' 54	10° 6' 3606	9° 88' 69	3	59
2	9° 34' 23	55	9° 37' 32	10° 6' 3548	9° 88' 67	3	58
3	9° 35' 00	55	9° 38' 10	10° 6' 3491	9° 88' 64	3	57
4	9° 35' 37	55	9° 38' 48	10° 6' 3434	9° 88' 61	3	56
5	9° 36' 14	55	9° 39' 26	10° 6' 3376	9° 88' 58	3	55
6	9° 36' 51	55	9° 40' 04	10° 6' 3319	9° 88' 55	3	54
7	9° 37' 28	55	9° 40' 42	10° 6' 3262	9° 88' 52	3	53
8	9° 38' 06	54	9° 41' 20	10° 6' 3205	9° 88' 49	3	52
9	9° 38' 43	54	9° 41' 58	10° 6' 3148	9° 88' 46	3	51
10	9° 39' 20	54	9° 42' 36	10° 6' 3091	9° 88' 43	3	50
11	9° 39' 57	54	9° 43' 14	10° 6' 3034	9° 88' 40	3	49
12	9° 40' 34	54	9° 43' 52	10° 6' 2977	9° 88' 37	3	48
13	9° 41' 11	54	9° 44' 30	10° 6' 2920	9° 88' 34	3	47
14	9° 41' 48	54	9° 45' 08	10° 6' 2863	9° 88' 31	3	46
15	9° 42' 25	53	9° 45' 46	10° 6' 2807	9° 88' 28	3	45
16	9° 43' 02	53	9° 46' 24	10° 6' 2750	9° 88' 25	3	44
17	9° 43' 39	53	9° 47' 02	10° 6' 2694	9° 88' 22	3	43
18	9° 44' 16	53	9° 47' 40	10° 6' 2637	9° 88' 19	3	42
19	9° 44' 53	53	9° 48' 18	10° 6' 2581	9° 88' 16	3	41
20	9° 45' 30	53	9° 48' 56	10° 6' 2524	9° 88' 13	3	40
21	9° 46' 07	53	9° 49' 34	10° 6' 2468	9° 88' 10	3	39
22	9° 46' 44	53	9° 50' 12	10° 6' 2412	9° 88' 07	3	38
23	9° 47' 21	53	9° 50' 50	10° 6' 2356	9° 88' 04	3	37
24	9° 47' 58	53	9° 51' 28	10° 6' 2300	9° 88' 01	3	36
25	9° 48' 35	53	9° 52' 06	10° 6' 2244	9° 88' 98	3	35
26	9° 49' 12	53	9° 52' 44	10° 6' 2188	9° 88' 95	3	34
27	9° 49' 49	53	9° 53' 22	10° 6' 2132	9° 88' 92	3	33
28	9° 50' 26	53	9° 54' 00	10° 6' 2076	9° 88' 89	3	32
29	9° 51' 03	53	9° 54' 38	10° 6' 2020	9° 88' 86	3	31
30	9° 51' 40	53	9° 55' 16	10° 6' 1965	9° 88' 83	3	30
	Co-line.		Cotang.	Tangent.	Sine.		

[76 degrees.]

[13 degrees.]

	Sine.	Dist.	Tangent.	Cotang.	Co-line.	D.	
30	9° 36' 58	54	9° 38' 05	10° 6' 1965	9° 88' 78	3	39
31	9° 37' 35	53	9° 38' 43	10° 6' 1909	9° 88' 75	3	38
32	9° 38' 12	53	9° 39' 21	10° 6' 1853	9° 88' 72	3	37
33	9° 38' 49	53	9° 39' 59	10° 6' 1798	9° 88' 70	3	36
34	9° 39' 26	53	9° 40' 37	10° 6' 1743	9° 88' 67	3	35
35	9° 40' 03	53	9° 41' 15	10° 6' 1687	9° 88' 64	3	34
36	9° 40' 40	53	9° 41' 53	10° 6' 1632	9° 88' 61	3	33
37	9° 41' 17	52	9° 42' 31	10° 6' 1577	9° 88' 58	3	32
38	9° 41' 54	52	9° 43' 09	10° 6' 1521	9° 88' 55	3	31
39	9° 42' 31	52	9° 43' 47	10° 6' 1466	9° 88' 52	3	30
40	9° 43' 08	52	9° 44' 25	10° 6' 1411	9° 88' 49	3	29
41	9° 43' 45	52	9° 45' 03	10° 6' 1356	9° 88' 46	3	28
42	9° 44' 22	52	9° 45' 41	10° 6' 1301	9° 88' 43	3	27
43	9° 44' 59	51	9° 46' 19	10° 6' 1246	9° 88' 40	3	26
44	9° 45' 36	51	9° 46' 57	10° 6' 1191	9° 88' 37	3	25
45	9° 46' 13	51	9° 47' 35	10° 6' 1137	9° 88' 34	3	24
46	9° 46' 50	51	9° 48' 13	10° 6' 1082	9° 88' 31	3	23
47	9° 47' 27	51	9° 48' 51	10° 6' 1028	9° 88' 28	3	22
48	9° 48' 04	51	9° 49' 29	10° 6' 0973	9° 88' 25	3	21
49	9° 48' 41	51	9° 50' 07	10° 6' 0918	9° 88' 22	3	20
50	9° 49' 18	51	9° 50' 45	10° 6' 0864	9° 88' 19	3	19
51	9° 49' 55	51	9° 51' 23	10° 6' 0810	9° 88' 16	3	18
52	9° 50' 32	51	9° 52' 01	10° 6' 0755	9° 88' 13	3	17
53	9° 51' 09	51	9° 52' 39	10° 6' 0701	9° 88' 10	3	16
54	9° 51' 46	51	9° 53' 17	10° 6' 0647	9° 88' 07	3	15
55	9° 52' 23	51	9° 53' 55	10° 6' 0593	9° 88' 04	3	14
56	9° 53' 00	51	9° 54' 33	10° 6' 0539	9° 88' 01	3	13
57	9° 53' 37	51	9° 55' 11	10° 6' 0485	9° 88' 98	3	12
58	9° 54' 14	51	9° 55' 49	10° 6' 0431	9° 88' 95	3	11
59	9° 54' 51	51	9° 56' 27	10° 6' 0377	9° 88' 92	3	10
60	9° 55' 28	51	9° 57' 05	10° 6' 0323	9° 88' 89	3	9
	Co-line.		Cotang.	Tangent.	Sine.		

[76 degrees.]

[14 degrees.]

°	'	Sine.	Dif.	Tangent.	Cotang.	Co-sine.	D.	'
0	9 13 68	50	9 13 67	54	10 60 123	9 13 600	3	60
1	9 13 48	51	9 13 71	54	10 60 269	9 13 687	3	59
2	9 13 26	51	9 13 78	54	10 60 415	9 13 684	3	58
3	9 13 10	50	9 13 38	53	10 60 165	9 13 681	3	57
4	9 13 70	51	9 13 52	54	10 60 108	9 13 678	3	56
5	9 13 20	50	9 13 59	53	10 60 051	9 13 675	3	55
6	9 13 20	50	9 13 59	54	10 60 001	9 13 671	4	54
7	9 13 21	51	9 13 52	53	10 59 948	9 13 668	3	53
8	9 13 21	50	9 13 52	54	10 59 894	9 13 665	3	52
9	9 13 21	50	9 13 52	53	10 59 841	9 13 662	3	51
10	9 13 21	50	9 13 52	54	10 59 788	9 13 659	3	50
11	9 13 21	50	9 13 52	53	10 59 734	9 13 656	3	49
12	9 13 21	50	9 13 52	53	10 59 681	9 13 652	4	48
13	9 13 21	50	9 13 52	53	10 59 628	9 13 649	3	47
14	9 13 21	50	9 13 52	53	10 59 575	9 13 646	3	46
15	9 13 21	50	9 13 52	53	10 59 522	9 13 643	3	45
16	9 13 21	49	9 13 52	53	10 59 469	9 13 640	3	44
17	9 13 21	49	9 13 52	53	10 59 416	9 13 636	4	43
18	9 13 21	49	9 13 52	53	10 59 363	9 13 633	3	42
19	9 13 21	49	9 13 52	53	10 59 311	9 13 630	3	41
20	9 13 21	49	9 13 52	53	10 59 258	9 13 627	3	40
21	9 13 21	49	9 13 52	53	10 59 205	9 13 623	3	39
22	9 13 21	49	9 13 52	53	10 59 153	9 13 620	3	38
23	9 13 21	49	9 13 52	53	10 59 100	9 13 617	3	37
24	9 13 21	49	9 13 52	53	10 59 048	9 13 614	3	36
25	9 13 21	49	9 13 52	53	10 58 995	9 13 610	3	35
26	9 13 21	49	9 13 52	53	10 58 943	9 13 607	3	34
27	9 13 21	49	9 13 52	53	10 58 891	9 13 604	3	33
28	9 13 21	49	9 13 52	53	10 58 839	9 13 601	3	32
29	9 13 21	49	9 13 52	53	10 58 786	9 13 597	3	31
30	9 13 21	49	9 13 52	53	10 58 734	9 13 594	3	30
31	9 13 21	49	9 13 52	53	10 58 681	9 13 591	3	29
32	9 13 21	49	9 13 52	53	10 58 628	9 13 588	3	28
33	9 13 21	49	9 13 52	53	10 58 575	9 13 585	3	27
34	9 13 21	49	9 13 52	53	10 58 522	9 13 582	3	26
35	9 13 21	49	9 13 52	53	10 58 469	9 13 579	3	25
36	9 13 21	49	9 13 52	53	10 58 416	9 13 576	3	24
37	9 13 21	49	9 13 52	53	10 58 363	9 13 573	3	23
38	9 13 21	49	9 13 52	53	10 58 311	9 13 570	3	22
39	9 13 21	49	9 13 52	53	10 58 258	9 13 567	3	21
40	9 13 21	49	9 13 52	53	10 58 205	9 13 564	3	20
41	9 13 21	49	9 13 52	53	10 58 153	9 13 561	3	19
42	9 13 21	49	9 13 52	53	10 58 100	9 13 558	3	18
43	9 13 21	49	9 13 52	53	10 58 048	9 13 555	3	17
44	9 13 21	49	9 13 52	53	10 57 995	9 13 552	3	16
45	9 13 21	49	9 13 52	53	10 57 943	9 13 549	3	15
46	9 13 21	49	9 13 52	53	10 57 891	9 13 546	3	14
47	9 13 21	49	9 13 52	53	10 57 839	9 13 543	3	13
48	9 13 21	49	9 13 52	53	10 57 786	9 13 540	3	12
49	9 13 21	49	9 13 52	53	10 57 734	9 13 537	3	11
50	9 13 21	49	9 13 52	53	10 57 681	9 13 534	3	10
51	9 13 21	49	9 13 52	53	10 57 628	9 13 531	3	9
52	9 13 21	49	9 13 52	53	10 57 575	9 13 528	3	8
53	9 13 21	49	9 13 52	53	10 57 522	9 13 525	3	7
54	9 13 21	49	9 13 52	53	10 57 469	9 13 522	3	6
55	9 13 21	49	9 13 52	53	10 57 416	9 13 519	3	5
56	9 13 21	49	9 13 52	53	10 57 363	9 13 516	3	4
57	9 13 21	49	9 13 52	53	10 57 311	9 13 513	3	3
58	9 13 21	49	9 13 52	53	10 57 258	9 13 510	3	2
59	9 13 21	49	9 13 52	53	10 57 205	9 13 507	3	1
60	9 13 21	49	9 13 52	53	10 57 153	9 13 504	3	0

[75 degrees.]

[14 degrees.]

°	'	Sine.	Dif.	Tangent.	Cotang.	Co-sine.	D.	'
30	9 13860	49	9 13 66	52	10 58714	9 08594	3	30
31	9 13909	49	9 13 18	52	10 58683	9 08591	3	29
32	9 13958	48	9 13 70	52	10 58650	9 08588	3	28
33	9 14006	48	9 14 22	52	10 58617	9 08584	4	27
34	9 14055	48	9 14 74	52	10 58584	9 08581	3	26
35	9 14103	49	9 15 26	52	10 58551	9 08578	3	25
36	9 14152	48	9 15 78	52	10 58518	9 08574	4	24
37	9 14200	49	9 16 30	52	10 58485	9 08571	3	23
38	9 14249	48	9 16 82	52	10 58452	9 08568	3	22
39	9 14297	48	9 17 34	52	10 58419	9 08564	3	21
40	9 14346	48	9 17 86	52	10 58386	9 08561	4	20
41	9 14394	48	9 18 38	52	10 58353	9 08558	3	19
42	9 14442	48	9 18 90	52	10 58320	9 08554	3	18
43	9 14490	48	9 19 42	52	10 58287	9 08551	4	17
44	9 14538	48	9 19 94	52	10 58254	9 08548	3	16
45	9 14586	48	9 20 46	52	10 58221	9 08544	3	15
46	9 14634	48	9 20 98	52	10 58188	9 08541	4	14
47	9 14682	48	9 21 50	52	10 58155	9 08538	3	13
48	9 14730	48	9 22 02	52	10 58122	9 08535	3	12
49	9 14778	47	9 22 54	52	10 58089	9 08532	4	11
50	9 14825	48	9 23 06	52	10 58056	9 08529	3	10
51	9 14873	48	9 23 58	52	10 58023	9 08526	3	9
52	9 14921	47	9 24 10	52	10 57990	9 08523	4	8
53	9 14968	48	9 25 14	52	10 57957	9 08520	3	7
54	9 15016	47	9 25 66	52	10 57924	9 08517	3	6
55	9 15063	48	9 26 18	52	10 57891	9 08514	4	5
56	9 15111	47	9 26 70	52	10 57858	9 08511	3	4
57	9 15158	47	9 27 22	52	10 57825	9 08508	3	3
58	9 15205	47	9 27 74	52	10 57792	9 08505	4	2
59	9 15252	48	9 28 26	52	10 57759	9 08502	3	1
60	9 15300		9 28 78	52	10 57726	9 08499	4	0
°	'	Co-sine.	Cotang.	Tangent.	Sine.	D.	'	

[75 degrees.]

[15 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.
30	9'42690	45	9'44299	49	10'55701	9'98391	30
31	9'42735	46	9'44348	49	10'55652	9'98388	29
32	9'42781	45	9'44397	49	10'55603	9'98384	28
33	9'42826	46	9'44446	49	10'55554	9'98381	27
34	9'42872	45	9'44495	49	10'55505	9'98377	26
35	9'42917	46	9'44544	49	10'55456	9'98373	25
36	9'42962	45	9'44592	49	10'55408	9'98370	24
37	9'43008	46	9'44641	49	10'55359	9'98366	23
38	9'43053	45	9'44690	49	10'55310	9'98363	22
39	9'43098	46	9'44738	49	10'55262	9'98359	21
40	9'43143	45	9'44787	49	10'55213	9'98356	20
41	9'43188	46	9'44836	49	10'55164	9'98352	19
42	9'43233	45	9'44884	49	10'55116	9'98349	18
43	9'43278	46	9'44933	49	10'55067	9'98345	17
44	9'43323	45	9'44981	49	10'55019	9'98342	16
45	9'43367	46	9'45029	49	10'54971	9'98338	15
46	9'43412	45	9'45078	49	10'54922	9'98334	14
47	9'43457	46	9'45126	49	10'54874	9'98331	13
48	9'43502	45	9'45174	49	10'54826	9'98327	12
49	9'43546	46	9'45222	49	10'54778	9'98324	11
50	9'43591	45	9'45271	49	10'54729	9'98320	10
51	9'43635	46	9'45319	49	10'54681	9'98317	9
52	9'43680	45	9'45367	49	10'54633	9'98313	8
53	9'43724	46	9'45415	49	10'54585	9'98309	7
54	9'43769	45	9'45463	49	10'54537	9'98306	6
55	9'43813	46	9'45511	49	10'54489	9'98302	5
56	9'43857	45	9'45559	49	10'54441	9'98299	4
57	9'43901	46	9'45606	49	10'54394	9'98295	3
58	9'43946	45	9'45654	49	10'54346	9'98291	2
59	9'43990	46	9'45702	49	10'54298	9'98288	1
60	9'44034	45	9'45750	49	10'54250	9'98284	0
'	Cosine.	Cotang.	Tangent.	Diff.	Cotang.	Sine.	

[74 degrees.]

[15 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.
0	9'41100	47	9'42805	51	10'57195	9'98494	60
1	9'41147	47	9'42856	50	10'57144	9'98491	59
2	9'41194	47	9'42906	50	10'57094	9'98488	58
3	9'41241	47	9'42957	51	10'57043	9'98484	57
4	9'41288	47	9'43007	50	10'56993	9'98481	56
5	9'41335	47	9'43057	51	10'56943	9'98477	55
6	9'41382	47	9'43108	50	10'56892	9'98474	54
7	9'41429	47	9'43158	50	10'56842	9'98471	53
8	9'41475	47	9'43208	51	10'56792	9'98467	52
9	9'41522	47	9'43258	50	10'56742	9'98464	51
10	9'41568	47	9'43308	50	10'56692	9'98460	50
11	9'41615	47	9'43358	51	10'56642	9'98457	49
12	9'41661	47	9'43408	50	10'56592	9'98453	48
13	9'41708	47	9'43458	50	10'56542	9'98450	47
14	9'41754	47	9'43508	51	10'56492	9'98447	46
15	9'41801	47	9'43558	49	10'56442	9'98443	45
16	9'41847	47	9'43607	50	10'56393	9'98440	44
17	9'41893	47	9'43657	50	10'56343	9'98436	43
18	9'41940	46	9'43707	49	10'56293	9'98433	42
19	9'41986	46	9'43756	50	10'56244	9'98429	41
20	9'42032	46	9'43806	49	10'56194	9'98426	40
21	9'42078	46	9'43855	50	10'56145	9'98422	39
22	9'42124	46	9'43905	49	10'56095	9'98419	38
23	9'42170	46	9'43954	50	10'56046	9'98415	37
24	9'42216	45	9'44004	49	10'55996	9'98412	36
25	9'42261	46	9'44053	49	10'55947	9'98409	35
26	9'42307	46	9'44102	50	10'55898	9'98405	34
27	9'42353	46	9'44151	50	10'55849	9'98402	33
28	9'42399	45	9'44201	49	10'55799	9'98398	32
29	9'42444	46	9'44250	49	10'55750	9'98395	31
30	9'42490	46	9'44299	49	10'55701	9'98391	30
'	Cosine.	Cotang.	Tangent.	Diff.	Cotang.	Sine.	

[74 degrees.]

[16 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cotane.	D.	
0	9°44'04	44	9°45'70	47	10°54'20	9°98'28	3	60
1	9°44'07	44	9°45'79	48	10°54'23	9°98'28	3	59
2	9°44'12	44	9°45'84	47	10°54'15	9°98'27	4	58
3	9°44'16	44	9°45'89	47	10°54'10	9°98'27	3	57
4	9°44'20	44	9°45'94	48	10°54'06	9°98'27	3	56
5	9°44'25	43	9°45'97	48	10°54'03	9°98'26	4	55
6	9°44'27	44	9°46'03	47	10°53'56	9°98'26	3	54
7	9°44'31	44	9°46'08	47	10°53'51	9°98'25	3	53
8	9°44'35	43	9°46'10	47	10°53'47	9°98'25	4	52
9	9°44'38	44	9°46'17	47	10°53'42	9°98'25	3	51
10	9°44'42	44	9°46'24	47	10°53'37	9°98'24	3	50
11	9°44'46	43	9°46'27	48	10°53'29	9°98'24	4	49
12	9°44'50	43	9°46'31	47	10°53'21	9°98'24	3	48
13	9°44'54	43	9°46'36	47	10°53'14	9°98'23	4	47
14	9°44'58	43	9°46'41	47	10°53'07	9°98'23	4	46
15	9°45'02	43	9°46'46	47	10°53'00	9°98'22	4	45
16	9°45'06	43	9°46'50	47	10°52'54	9°98'22	4	44
17	9°45'10	43	9°46'55	47	10°52'47	9°98'21	4	43
18	9°45'14	43	9°46'59	47	10°52'40	9°98'21	4	42
19	9°45'18	43	9°47'03	47	10°52'33	9°98'21	3	41
20	9°45'22	43	9°47'07	47	10°52'26	9°98'21	4	40
21	9°45'26	43	9°47'11	47	10°52'19	9°98'20	4	39
22	9°45'30	43	9°47'15	47	10°52'12	9°98'20	3	38
23	9°45'34	42	9°47'19	46	10°52'05	9°98'20	4	37
24	9°45'38	43	9°47'23	47	10°51'58	9°98'19	4	36
25	9°45'42	43	9°47'27	47	10°51'51	9°98'19	3	35
26	9°45'46	43	9°47'31	46	10°51'44	9°98'19	3	34
27	9°45'50	43	9°47'35	46	10°51'37	9°98'18	4	33
28	9°45'54	43	9°47'39	46	10°51'30	9°98'18	4	32
29	9°45'58	42	9°47'43	46	10°51'23	9°98'17	4	31
30	9°46'02	42	9°47'47	46	10°51'16	9°98'17	3	30

[73 degrees.]

[16 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cotane.	D.	
30	9°45'34	43	9°47'16	47	10°52'40	9°98'17	4	30
31	9°45'37	43	9°47'20	47	10°52'33	9°98'17	4	29
32	9°45'41	43	9°47'25	46	10°52'27	9°98'16	4	28
33	9°45'45	43	9°47'29	46	10°52'20	9°98'16	4	27
34	9°45'49	42	9°47'34	46	10°52'14	9°98'15	3	26
35	9°45'53	42	9°47'39	46	10°52'08	9°98'15	4	25
36	9°45'57	42	9°47'43	46	10°52'02	9°98'15	4	24
37	9°46'01	42	9°47'48	46	10°51'56	9°98'14	3	23
38	9°46'05	42	9°47'53	46	10°51'50	9°98'14	3	22
39	9°46'09	42	9°47'57	46	10°51'44	9°98'14	4	21
40	9°46'13	42	9°48'02	46	10°51'38	9°98'13	4	20
41	9°46'17	42	9°48'06	46	10°51'32	9°98'13	4	19
42	9°46'21	42	9°48'11	46	10°51'26	9°98'12	3	18
43	9°46'25	42	9°48'15	46	10°51'20	9°98'12	4	17
44	9°46'29	42	9°48'20	46	10°51'14	9°98'11	4	16
45	9°46'33	41	9°48'24	45	10°51'08	9°98'11	4	15
46	9°46'37	41	9°48'29	45	10°51'02	9°98'11	3	14
47	9°46'41	41	9°48'33	45	10°50'57	9°98'10	3	13
48	9°46'45	41	9°48'38	45	10°50'51	9°98'10	4	12
49	9°46'49	41	9°48'42	45	10°50'45	9°98'10	4	11
50	9°46'53	41	9°48'47	45	10°50'39	9°98'09	4	10
51	9°46'57	41	9°48'51	45	10°50'33	9°98'09	4	9
52	9°47'01	41	9°48'56	45	10°50'27	9°98'09	4	8
53	9°47'05	41	9°49'00	45	10°50'21	9°98'08	3	7
54	9°47'09	41	9°49'05	45	10°50'15	9°98'08	4	6
55	9°47'13	41	9°49'09	45	10°50'09	9°98'07	4	5
56	9°47'17	41	9°49'14	45	10°50'03	9°98'07	4	4
57	9°47'21	41	9°49'18	45	10°50'00	9°98'07	4	3
58	9°47'25	41	9°49'23	45	10°49'54	9°98'06	4	2
59	9°47'29	41	9°49'27	45	10°49'48	9°98'06	4	1
60	9°47'33	41	9°49'32	45	10°49'42	9°98'06	3	0

[73 degrees.]

[17 degrees.]

'	Sine.	DIF.	Tangent.	DIF.	Cotang.	Co-sine.	'
0	9.46594	41	9.48534	45	10.51466	9.98060	60
1	9.46635	41	9.48579	45	10.51421	9.98056	4
2	9.46676	41	9.48624	45	10.51376	9.98052	4
3	9.46717	41	9.48669	45	10.51331	9.98048	4
4	9.46758	42	9.48714	45	10.51286	9.98044	4
5	9.46800	41	9.48759	45	10.51241	9.98040	4
6	9.46841	41	9.48804	45	10.51196	9.98036	4
7	9.46882	41	9.48849	45	10.51151	9.98032	3
8	9.46923	41	9.48894	45	10.51106	9.98029	3
9	9.46964	41	9.48939	45	10.51061	9.98025	4
10	9.47005	40	9.48984	45	10.51016	9.98021	4
11	9.47045	41	9.49029	45	10.50971	9.98017	4
12	9.47086	41	9.49073	44	10.50927	9.98013	4
13	9.47127	41	9.49118	45	10.50882	9.98009	4
14	9.47168	41	9.49163	45	10.50837	9.98005	4
15	9.47209	40	9.49207	45	10.50793	9.98001	4
16	9.47249	41	9.49252	44	10.50748	9.97997	4
17	9.47290	40	9.49296	45	10.50704	9.97993	4
18	9.47330	41	9.49341	45	10.50659	9.97989	4
19	9.47371	40	9.49385	45	10.50615	9.97986	3
20	9.47411	41	9.49430	44	10.50570	9.97982	4
21	9.47452	40	9.49474	45	10.50526	9.97978	4
22	9.47492	41	9.49519	44	10.50481	9.97974	4
23	9.47533	40	9.49563	45	10.50437	9.97970	3
24	9.47573	40	9.49607	45	10.50393	9.97966	4
25	9.47613	41	9.49652	44	10.50348	9.97962	4
26	9.47654	40	9.49696	45	10.50304	9.97958	4
27	9.47694	40	9.49740	44	10.50260	9.97954	4
28	9.47734	40	9.49784	44	10.50216	9.97950	4
29	9.47774	40	9.49828	44	10.50172	9.97946	4
30	9.47814	40	9.49872	44	10.50128	9.97942	4
'	Co-sine.		Cotang.		Tangent.	Sine.	'

[72 degrees.]

[17 degrees.]

'	Sine.	DIF.	Tangent.	DIF.	Cotang.	Co-sine.	'
30	9.47814	40	9.49872	44	10.50128	9.97942	30
31	9.47854	40	9.49916	44	10.50084	9.97938	4
32	9.47894	40	9.49960	44	10.50040	9.97934	4
33	9.47934	40	9.50004	44	10.49996	9.97930	4
34	9.47974	40	9.50048	44	10.49952	9.97926	4
35	9.48014	40	9.50092	44	10.49908	9.97922	4
36	9.48054	40	9.50136	44	10.49864	9.97918	4
37	9.48094	39	9.50180	43	10.49820	9.97914	4
38	9.48133	40	9.50223	44	10.49777	9.97910	4
39	9.48173	40	9.50267	44	10.49733	9.97906	4
40	9.48213	39	9.50311	44	10.49689	9.97902	4
41	9.48252	40	9.50355	43	10.49645	9.97898	4
42	9.48292	40	9.50398	44	10.49601	9.97894	4
43	9.48332	39	9.50442	43	10.49558	9.97890	4
44	9.48371	40	9.50485	44	10.49515	9.97886	4
45	9.48411	39	9.50529	43	10.49471	9.97882	4
46	9.48450	40	9.50572	44	10.49428	9.97878	4
47	9.48490	39	9.50616	43	10.49384	9.97874	4
48	9.48529	39	9.50659	44	10.49341	9.97870	4
49	9.48568	39	9.50703	43	10.49297	9.97866	5
50	9.48607	40	9.50746	43	10.49254	9.97861	4
51	9.48647	39	9.50789	44	10.49211	9.97857	4
52	9.48686	39	9.50833	43	10.49167	9.97853	4
53	9.48725	39	9.50876	43	10.49124	9.97849	4
54	9.48764	39	9.50919	43	10.49081	9.97845	4
55	9.48803	39	9.50962	43	10.49038	9.97841	4
56	9.48842	39	9.51005	43	10.48995	9.97837	4
57	9.48881	39	9.51048	44	10.48952	9.97833	4
58	9.48920	39	9.51092	43	10.48908	9.97829	4
59	9.48959	39	9.51135	43	10.48865	9.97825	4
60	9.48998	39	9.51178	43	10.48822	9.97821	4
'	Co-sine.		Cotang.		Tangent.	Sine.	'

[72 degrees.]



[18 degrees.]

°	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	'
0	9°4908	39	9°51178	43	10°48822	9°97821	4	60
1	9°4907	39	9°51221	43	10°48779	9°97817	4	59
2	9°4906	39	9°51264	42	10°48736	9°97812	5	58
3	9°4915	38	9°51306	43	10°48694	9°97808	4	57
4	9°4913	38	9°51349	43	10°48651	9°97804	4	56
5	9°4914	39	9°51392	43	10°48608	9°97800	4	55
6	9°4921	38	9°51435	43	10°48565	9°97796	4	54
7	9°4920	38	9°51478	42	10°48522	9°97792	4	53
8	9°49308	39	9°51520	43	10°48480	9°97788	4	52
9	9°49347	38	9°51563	43	10°48437	9°97784	4	51
10	9°49385	39	9°51606	43	10°48394	9°97779	5	50
11	9°49424	38	9°51648	42	10°48352	9°97775	4	49
12	9°49462	38	9°51691	43	10°48309	9°97771	4	48
13	9°49500	39	9°51734	42	10°48266	9°97767	4	47
14	9°49539	38	9°51776	43	10°48224	9°97763	4	46
15	9°49577	38	9°51819	42	10°48181	9°97759	5	45
16	9°49615	39	9°51861	43	10°48139	9°97754	4	44
17	9°49654	38	9°51903	43	10°48097	9°97750	4	43
18	9°49692	38	9°51946	42	10°48054	9°97746	4	42
19	9°49730	38	9°51988	43	10°48012	9°97742	4	41
20	9°49768	38	9°52031	42	10°47969	9°97738	4	40
21	9°49806	38	9°52073	43	10°47927	9°97734	5	39
22	9°49844	38	9°52115	42	10°47885	9°97729	4	38
23	9°49882	38	9°52157	43	10°47843	9°97725	4	37
24	9°49920	38	9°52200	42	10°47800	9°97721	4	36
25	9°49958	38	9°52242	43	10°47758	9°97717	4	35
26	9°49996	38	9°52284	42	10°47716	9°97713	4	34
27	9°50034	38	9°52326	42	10°47674	9°97708	5	33
28	9°50072	38	9°52368	43	10°47632	9°97704	4	32
29	9°50110	38	9°52410	42	10°47590	9°97700	4	31
30	9°50148	38	9°52452	42	10°47548	9°97696	4	30
'	Cosine.		Cotang.		Tangent.	Sine.		'

[71 degrees.]

[18 degrees.]

°	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	'
30	9°50148	37	9°52452	42	10°47548	9°97696	5	29
31	9°50185	38	9°52494	42	10°47506	9°97691	4	28
32	9°50223	38	9°52536	42	10°47464	9°97687	4	27
33	9°50261	37	9°52578	42	10°47422	9°97683	4	26
34	9°50298	38	9°52620	41	10°47380	9°97679	5	25
35	9°50336	38	9°52661	42	10°47339	9°97674	4	24
36	9°50374	37	9°52703	42	10°47297	9°97670	4	23
37	9°50411	37	9°52745	42	10°47255	9°97666	4	22
38	9°50449	38	9°52787	42	10°47213	9°97662	5	21
39	9°50486	37	9°52829	41	10°47171	9°97657	4	20
40	9°50523	38	9°52870	42	10°47130	9°97653	4	19
41	9°50561	37	9°52912	41	10°47088	9°97649	4	18
42	9°50598	37	9°52953	42	10°47047	9°97645	5	17
43	9°50635	38	9°52995	42	10°47005	9°97640	4	16
44	9°50673	37	9°53037	41	10°46963	9°97636	4	15
45	9°50710	37	9°53078	42	10°46922	9°97632	4	14
46	9°50747	37	9°53120	41	10°46880	9°97628	5	13
47	9°50784	37	9°53161	41	10°46839	9°97623	4	12
48	9°50821	37	9°53202	42	10°46798	9°97619	4	11
49	9°50858	38	9°53244	41	10°46756	9°97615	5	10
50	9°50896	37	9°53285	42	10°46715	9°97610	4	9
51	9°50933	37	9°53327	41	10°46673	9°97606	4	8
52	9°50970	37	9°53368	41	10°46632	9°97602	4	7
53	9°51007	36	9°53409	41	10°46591	9°97597	4	6
54	9°51043	37	9°53450	42	10°46550	9°97593	4	5
55	9°51080	37	9°53492	41	10°46508	9°97589	5	4
56	9°51117	37	9°53533	41	10°46467	9°97584	4	3
57	9°51154	37	9°53574	41	10°46426	9°97580	4	2
58	9°51191	36	9°53615	41	10°46385	9°97576	4	1
59	9°51227	37	9°53656	41	10°46344	9°97572	5	0
60	9°51264	37	9°53697	41	10°46303	9°97567	4	0
'	Cosine.		Cotang.		Tangent.	Sine.		'

[71 degrees.]

[19 degrees.]

'	Sine.	Tangent.	Diff.	Sine.	Diff.	Tangent.	Diff.	Cotang.	Consec.	D.	'
30	9° 52' 16"	37	9° 53' 67"	10° 46' 30"	41	9° 53' 67"	10° 46' 30"	9° 53' 67"	9° 53' 67"	5	30
31	9° 53' 10"	38	9° 54' 10"	10° 46' 31"	41	9° 54' 10"	10° 46' 31"	9° 54' 10"	9° 54' 10"	5	31
32	9° 54' 11"	39	9° 55' 11"	10° 46' 32"	41	9° 55' 11"	10° 46' 32"	9° 55' 11"	9° 55' 11"	5	32
33	9° 55' 13"	40	9° 56' 13"	10° 46' 33"	41	9° 56' 13"	10° 46' 33"	9° 56' 13"	9° 56' 13"	5	33
34	9° 56' 14"	41	9° 57' 14"	10° 46' 34"	41	9° 57' 14"	10° 46' 34"	9° 57' 14"	9° 57' 14"	5	34
35	9° 57' 15"	42	9° 58' 15"	10° 46' 35"	41	9° 58' 15"	10° 46' 35"	9° 58' 15"	9° 58' 15"	5	35
36	9° 58' 16"	43	9° 59' 16"	10° 46' 36"	41	9° 59' 16"	10° 46' 36"	9° 59' 16"	9° 59' 16"	5	36
37	9° 59' 17"	44	9° 60' 17"	10° 46' 37"	41	9° 60' 17"	10° 46' 37"	9° 60' 17"	9° 60' 17"	5	37
38	9° 60' 18"	45	9° 61' 18"	10° 46' 38"	41	9° 61' 18"	10° 46' 38"	9° 61' 18"	9° 61' 18"	5	38
39	9° 61' 19"	46	9° 62' 19"	10° 46' 39"	41	9° 62' 19"	10° 46' 39"	9° 62' 19"	9° 62' 19"	5	39
40	9° 62' 20"	47	9° 63' 20"	10° 46' 40"	41	9° 63' 20"	10° 46' 40"	9° 63' 20"	9° 63' 20"	5	40
41	9° 63' 21"	48	9° 64' 21"	10° 46' 41"	41	9° 64' 21"	10° 46' 41"	9° 64' 21"	9° 64' 21"	5	41
42	9° 64' 22"	49	9° 65' 22"	10° 46' 42"	41	9° 65' 22"	10° 46' 42"	9° 65' 22"	9° 65' 22"	5	42
43	9° 65' 23"	50	9° 66' 23"	10° 46' 43"	41	9° 66' 23"	10° 46' 43"	9° 66' 23"	9° 66' 23"	5	43
44	9° 66' 24"	51	9° 67' 24"	10° 46' 44"	41	9° 67' 24"	10° 46' 44"	9° 67' 24"	9° 67' 24"	5	44
45	9° 67' 25"	52	9° 68' 25"	10° 46' 45"	41	9° 68' 25"	10° 46' 45"	9° 68' 25"	9° 68' 25"	5	45
46	9° 68' 26"	53	9° 69' 26"	10° 46' 46"	41	9° 69' 26"	10° 46' 46"	9° 69' 26"	9° 69' 26"	5	46
47	9° 69' 27"	54	9° 70' 27"	10° 46' 47"	41	9° 70' 27"	10° 46' 47"	9° 70' 27"	9° 70' 27"	5	47
48	9° 70' 28"	55	9° 71' 28"	10° 46' 48"	41	9° 71' 28"	10° 46' 48"	9° 71' 28"	9° 71' 28"	5	48
49	9° 71' 29"	56	9° 72' 29"	10° 46' 49"	41	9° 72' 29"	10° 46' 49"	9° 72' 29"	9° 72' 29"	5	49
50	9° 72' 30"	57	9° 73' 30"	10° 46' 50"	41	9° 73' 30"	10° 46' 50"	9° 73' 30"	9° 73' 30"	5	50
51	9° 73' 31"	58	9° 74' 31"	10° 46' 51"	41	9° 74' 31"	10° 46' 51"	9° 74' 31"	9° 74' 31"	5	51
52	9° 74' 32"	59	9° 75' 32"	10° 46' 52"	41	9° 75' 32"	10° 46' 52"	9° 75' 32"	9° 75' 32"	5	52
53	9° 75' 33"	60	9° 76' 33"	10° 46' 53"	41	9° 76' 33"	10° 46' 53"	9° 76' 33"	9° 76' 33"	5	53
54	9° 76' 34"	61	9° 77' 34"	10° 46' 54"	41	9° 77' 34"	10° 46' 54"	9° 77' 34"	9° 77' 34"	5	54
55	9° 77' 35"	62	9° 78' 35"	10° 46' 55"	41	9° 78' 35"	10° 46' 55"	9° 78' 35"	9° 78' 35"	5	55
56	9° 78' 36"	63	9° 79' 36"	10° 46' 56"	41	9° 79' 36"	10° 46' 56"	9° 79' 36"	9° 79' 36"	5	56
57	9° 79' 37"	64	9° 80' 37"	10° 46' 57"	41	9° 80' 37"	10° 46' 57"	9° 80' 37"	9° 80' 37"	5	57
58	9° 80' 38"	65	9° 81' 38"	10° 46' 58"	41	9° 81' 38"	10° 46' 58"	9° 81' 38"	9° 81' 38"	5	58
59	9° 81' 39"	66	9° 82' 39"	10° 46' 59"	41	9° 82' 39"	10° 46' 59"	9° 82' 39"	9° 82' 39"	5	59
60	9° 82' 40"	67	9° 83' 40"	10° 47' 00"	41	9° 83' 40"	10° 47' 00"	9° 83' 40"	9° 83' 40"	5	60

[70 degrees.]

[19 degrees.]

'	Sine.	Tangent.	Diff.	Cotang.	Consec.	D.	'
0	9° 51' 26"	37	9° 53' 67"	10° 46' 30"	9° 53' 67"	10° 46' 30"	60
1	9° 51' 31"	38	9° 54' 10"	10° 46' 31"	9° 54' 10"	10° 46' 31"	59
2	9° 51' 36"	39	9° 55' 11"	10° 46' 32"	9° 55' 11"	10° 46' 32"	58
3	9° 51' 41"	40	9° 56' 13"	10° 46' 33"	9° 56' 13"	10° 46' 33"	57
4	9° 51' 46"	41	9° 57' 14"	10° 46' 34"	9° 57' 14"	10° 46' 34"	56
5	9° 51' 51"	42	9° 58' 15"	10° 46' 35"	9° 58' 15"	10° 46' 35"	55
6	9° 51' 56"	43	9° 59' 16"	10° 46' 36"	9° 59' 16"	10° 46' 36"	54
7	9° 52' 01"	44	9° 60' 17"	10° 46' 37"	9° 60' 17"	10° 46' 37"	53
8	9° 52' 06"	45	9° 61' 18"	10° 46' 38"	9° 61' 18"	10° 46' 38"	52
9	9° 52' 11"	46	9° 62' 19"	10° 46' 39"	9° 62' 19"	10° 46' 39"	51
10	9° 52' 16"	47	9° 63' 20"	10° 46' 40"	9° 63' 20"	10° 46' 40"	50
11	9° 52' 21"	48	9° 64' 21"	10° 46' 41"	9° 64' 21"	10° 46' 41"	49
12	9° 52' 26"	49	9° 65' 22"	10° 46' 42"	9° 65' 22"	10° 46' 42"	48
13	9° 52' 31"	50	9° 66' 23"	10° 46' 43"	9° 66' 23"	10° 46' 43"	47
14	9° 52' 36"	51	9° 67' 24"	10° 46' 44"	9° 67' 24"	10° 46' 44"	46
15	9° 52' 41"	52	9° 68' 25"	10° 46' 45"	9° 68' 25"	10° 46' 45"	45
16	9° 52' 46"	53	9° 69' 26"	10° 46' 46"	9° 69' 26"	10° 46' 46"	44
17	9° 52' 51"	54	9° 70' 27"	10° 46' 47"	9° 70' 27"	10° 46' 47"	43
18	9° 52' 56"	55	9° 71' 28"	10° 46' 48"	9° 71' 28"	10° 46' 48"	42
19	9° 53' 01"	56	9° 72' 29"	10° 46' 49"	9° 72' 29"	10° 46' 49"	41
20	9° 53' 06"	57	9° 73' 30"	10° 46' 50"	9° 73' 30"	10° 46' 50"	40
21	9° 53' 11"	58	9° 74' 31"	10° 46' 51"	9° 74' 31"	10° 46' 51"	39
22	9° 53' 16"	59	9° 75' 32"	10° 46' 52"	9° 75' 32"	10° 46' 52"	38
23	9° 53' 21"	60	9° 76' 33"	10° 46' 53"	9° 76' 33"	10° 46' 53"	37
24	9° 53' 26"	61	9° 77' 34"	10° 46' 54"	9° 77' 34"	10° 46' 54"	36
25	9° 53' 31"	62	9° 78' 35"	10° 46' 55"	9° 78' 35"	10° 46' 55"	35
26	9° 53' 36"	63	9° 79' 36"	10° 46' 56"	9° 79' 36"	10° 46' 56"	34
27	9° 53' 41"	64	9° 80' 37"	10° 46' 57"	9° 80' 37"	10° 46' 57"	33
28	9° 53' 46"	65	9° 81' 38"	10° 46' 58"	9° 81' 38"	10° 46' 58"	32
29	9° 53' 51"	66	9° 82' 39"	10° 46' 59"	9° 82' 39"	10° 46' 59"	31
30	9° 53' 56"	67	9° 83' 40"	10° 47' 00"	9° 83' 40"	10° 47' 00"	30

[70 degrees.]

[20 degrees.]

'	Size.	Diff.	Tangent.	Colang.	Coline.	D.	'
30	9°54433	33	9°57274	10°42726	9°97159	5	30
31	9°54466	34	9°57312	10°42688	9°97154	5	29
32	9°54500	35	9°57351	10°42649	9°97149	5	28
33	9°54534	36	9°57389	10°42611	9°97145	5	27
34	9°54567	37	9°57428	10°42572	9°97140	5	26
35	9°54601	38	9°57466	10°42534	9°97135	5	25
36	9°54635	39	9°57504	10°42496	9°97130	5	24
37	9°54668	40	9°57543	10°42457	9°97126	5	23
38	9°54702	41	9°57581	10°42419	9°97121	5	22
39	9°54735	42	9°57619	10°42381	9°97116	5	21
40	9°54769	43	9°57658	10°42342	9°97111	5	20
41	9°54802	44	9°57696	10°42304	9°97107	5	19
42	9°54836	45	9°57734	10°42266	9°97102	5	18
43	9°54869	46	9°57772	10°42228	9°97097	5	17
44	9°54903	47	9°57810	10°42190	9°97092	5	16
45	9°54936	48	9°57849	10°42151	9°97087	5	15
46	9°54969	49	9°57887	10°42113	9°97083	5	14
47	9°55003	50	9°57925	10°42075	9°97078	5	13
48	9°55036	51	9°57963	10°42037	9°97073	5	12
49	9°55069	52	9°58001	10°41999	9°97068	5	11
50	9°55102	53	9°58039	10°41961	9°97063	5	10
51	9°55136	54	9°58077	10°41923	9°97059	5	9
52	9°55169	55	9°58115	10°41885	9°97054	5	8
53	9°55202	56	9°58153	10°41847	9°97049	5	7
54	9°55235	57	9°58191	10°41809	9°97044	5	6
55	9°55268	58	9°58229	10°41771	9°97039	5	5
56	9°55301	59	9°58267	10°41733	9°97035	5	4
57	9°55334	60	9°58304	10°41696	9°97030	5	3
58	9°55367	31	9°58342	10°41658	9°97025	5	2
59	9°55400	32	9°58380	10°41620	9°97020	5	1
60	9°55433	33	9°58418	10°41582	9°97015	5	0
'	Coline.	Colang.	Tangent.		Sine.		'

[69 degrees.]

'	Size.	Diff.	Tangent.	Colang.	Coline.	D.	'
0	9°53405	35	9°56107	10°43893	9°97299	5	60
1	9°53440	36	9°56146	10°43854	9°97294	5	59
2	9°53475	37	9°56185	10°43815	9°97289	5	58
3	9°53509	38	9°56224	10°43776	9°97285	5	57
4	9°53544	39	9°56264	10°43736	9°97280	5	56
5	9°53578	40	9°56303	10°43697	9°97276	5	55
6	9°53613	41	9°56342	10°43658	9°97271	5	54
7	9°53647	42	9°56381	10°43619	9°97266	5	53
8	9°53682	43	9°56420	10°43580	9°97262	5	52
9	9°53716	44	9°56459	10°43541	9°97257	5	51
10	9°53751	45	9°56498	10°43502	9°97252	5	50
11	9°53785	46	9°56537	10°43463	9°97248	5	49
12	9°53819	47	9°56576	10°43424	9°97243	5	48
13	9°53854	48	9°56615	10°43385	9°97238	5	47
14	9°53888	49	9°56654	10°43346	9°97234	5	46
15	9°53922	50	9°56693	10°43307	9°97229	5	45
16	9°53957	51	9°56732	10°43268	9°97224	5	44
17	9°53991	52	9°56771	10°43229	9°97220	5	43
18	9°54025	53	9°56810	10°43190	9°97215	5	42
19	9°54059	54	9°56849	10°43151	9°97210	5	41
20	9°54093	55	9°56887	10°43113	9°97206	5	40
21	9°54127	56	9°56926	10°43074	9°97201	5	39
22	9°54161	57	9°56965	10°43035	9°97196	5	38
23	9°54195	58	9°57004	10°42996	9°97192	5	37
24	9°54229	59	9°57042	10°42958	9°97187	5	36
25	9°54263	60	9°57081	10°42919	9°97182	5	35
26	9°54297	31	9°57120	10°42880	9°97178	5	34
27	9°54331	32	9°57158	10°42842	9°97173	5	33
28	9°54365	33	9°57197	10°42803	9°97168	5	32
29	9°54399	34	9°57235	10°42765	9°97163	5	31
30	9°54433	35	9°57274	10°42726	9°97159	5	30
'	Coline.	Colang.	Tangent.		Sine.		'

[69 degrees.]

[19 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	'
0	9° 51' 26"	37	9° 53' 67"	41	10° 46' 30"	9° 97' 567"	4	60
1	9° 51' 38"	37	9° 53' 38"	41	10° 46' 262"	9° 97' 561"	4	59
2	9° 51' 50"	37	9° 53' 79"	41	10° 46' 221"	9° 97' 558"	4	58
3	9° 51' 54"	36	9° 53' 80"	41	10° 46' 180"	9° 97' 554"	4	57
4	9° 51' 41"	36	9° 53' 861"	41	10° 46' 139"	9° 97' 550"	4	56
5	9° 51' 447"	36	9° 53' 902"	41	10° 46' 098"	9° 97' 545"	4	55
6	9° 51' 484"	36	9° 53' 943"	41	10° 46' 057"	9° 97' 541"	4	54
7	9° 51' 520"	36	9° 53' 984"	41	10° 46' 016"	9° 97' 536"	4	53
8	9° 51' 557"	36	9° 54' 025"	40	10° 45' 975"	9° 97' 532"	4	52
9	9° 51' 593"	36	9° 54' 066"	41	10° 45' 934"	9° 97' 528"	4	51
10	9° 52' 030"	37	9° 54' 107"	41	10° 45' 894"	9° 97' 523"	4	50
11	9° 52' 066"	36	9° 54' 147"	40	10° 45' 853"	9° 97' 519"	4	49
12	9° 52' 102"	36	9° 54' 187"	41	10° 45' 813"	9° 97' 515"	4	48
13	9° 52' 138"	36	9° 54' 228"	41	10° 45' 772"	9° 97' 510"	4	47
14	9° 52' 174"	37	9° 54' 269"	40	10° 45' 731"	9° 97' 506"	4	46
15	9° 52' 211"	36	9° 54' 309"	41	10° 45' 691"	9° 97' 501"	4	45
16	9° 52' 247"	36	9° 54' 350"	40	10° 45' 650"	9° 97' 497"	4	44
17	9° 52' 283"	36	9° 54' 390"	41	10° 45' 610"	9° 97' 493"	4	43
18	9° 52' 319"	36	9° 54' 431"	40	10° 45' 569"	9° 97' 488"	4	42
19	9° 52' 355"	36	9° 54' 471"	41	10° 45' 528"	9° 97' 484"	4	41
20	9° 52' 391"	36	9° 54' 512"	40	10° 45' 488"	9° 97' 479"	4	40
21	9° 52' 427"	36	9° 54' 552"	41	10° 45' 448"	9° 97' 475"	4	39
22	9° 52' 463"	36	9° 54' 593"	40	10° 45' 407"	9° 97' 470"	4	38
23	9° 52' 500"	36	9° 55' 033"	40	10° 45' 367"	9° 97' 466"	4	37
24	9° 52' 535"	36	9° 55' 074"	41	10° 45' 326"	9° 97' 461"	4	36
25	9° 52' 571"	36	9° 55' 114"	40	10° 45' 286"	9° 97' 457"	4	35
26	9° 53' 007"	35	9° 55' 154"	40	10° 45' 246"	9° 97' 453"	4	34
27	9° 53' 043"	36	9° 55' 194"	41	10° 45' 206"	9° 97' 448"	4	33
28	9° 53' 079"	36	9° 55' 235"	40	10° 45' 165"	9° 97' 444"	4	32
29	9° 53' 114"	36	9° 55' 275"	40	10° 45' 125"	9° 97' 439"	4	31
30	9° 53' 150"	36	9° 55' 315"	40	10° 45' 085"	9° 97' 435"	4	30
'	Cosine.	Cotang.	Tangent.	Sine.				

[70 degrees.]

[19 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	'
30	9° 53' 190"	35	9° 55' 350"	39	10° 45' 045"	9° 97' 430"	5	29
31	9° 53' 185"	36	9° 55' 390"	39	10° 45' 005"	9° 97' 426"	5	28
32	9° 53' 181"	35	9° 55' 430"	40	10° 44' 965"	9° 97' 421"	5	27
33	9° 53' 176"	36	9° 55' 470"	40	10° 44' 925"	9° 97' 417"	5	26
34	9° 53' 171"	35	9° 55' 510"	40	10° 44' 885"	9° 97' 413"	5	25
35	9° 53' 167"	36	9° 55' 550"	40	10° 44' 845"	9° 97' 408"	5	24
36	9° 53' 163"	35	9° 55' 590"	39	10° 44' 805"	9° 97' 403"	5	23
37	9° 53' 158"	36	9° 56' 030"	39	10° 44' 765"	9° 97' 399"	5	22
38	9° 53' 154"	35	9° 56' 070"	40	10° 44' 725"	9° 97' 394"	5	21
39	9° 53' 150"	36	9° 56' 110"	40	10° 44' 685"	9° 97' 390"	5	20
40	9° 53' 145"	35	9° 56' 150"	39	10° 44' 645"	9° 97' 385"	5	19
41	9° 53' 141"	36	9° 56' 190"	40	10° 44' 605"	9° 97' 381"	5	18
42	9° 53' 137"	35	9° 56' 230"	39	10° 44' 565"	9° 97' 376"	5	17
43	9° 53' 133"	36	9° 56' 270"	40	10° 44' 525"	9° 97' 372"	5	16
44	9° 53' 129"	35	9° 56' 310"	40	10° 44' 485"	9° 97' 367"	5	15
45	9° 53' 125"	36	9° 56' 350"	39	10° 44' 445"	9° 97' 363"	5	14
46	9° 53' 121"	35	9° 56' 390"	40	10° 44' 405"	9° 97' 358"	5	13
47	9° 53' 117"	36	9° 56' 430"	40	10° 44' 365"	9° 97' 353"	5	12
48	9° 53' 113"	35	9° 56' 470"	39	10° 44' 325"	9° 97' 349"	5	11
49	9° 53' 109"	36	9° 56' 510"	40	10° 44' 285"	9° 97' 344"	5	10
50	9° 53' 105"	35	9° 56' 550"	39	10° 44' 245"	9° 97' 340"	5	9
51	9° 53' 101"	36	9° 56' 590"	40	10° 44' 205"	9° 97' 335"	5	8
52	9° 53' 097"	35	9° 57' 030"	39	10° 44' 165"	9° 97' 331"	5	7
53	9° 53' 093"	36	9° 57' 070"	40	10° 44' 125"	9° 97' 326"	5	6
54	9° 53' 089"	35	9° 57' 110"	39	10° 44' 085"	9° 97' 322"	5	5
55	9° 53' 085"	36	9° 57' 150"	40	10° 44' 045"	9° 97' 317"	5	4
56	9° 53' 081"	35	9° 57' 190"	39	10° 44' 005"	9° 97' 312"	5	3
57	9° 53' 077"	36	9° 57' 230"	40	10° 43' 965"	9° 97' 308"	5	2
58	9° 53' 073"	35	9° 57' 270"	39	10° 43' 925"	9° 97' 303"	5	1
59	9° 53' 069"	36	9° 57' 310"	40	10° 43' 885"	9° 97' 299"	5	0
60	9° 53' 065"	35	9° 57' 350"	39	10° 43' 845"	9° 97' 295"	5	0
'	Cosine.	Cotang.	Tangent.	Sine.				

[70 degrees.]

[20 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Co-line.	D.	
30	9.54433	33	9.57274	38	10.42726	9.97159	5	30
31	9.54466	34	9.57312	39	10.42688	9.97154	5	29
32	9.54500	34	9.57351	38	10.42649	9.97149	5	28
33	9.54534	33	9.57389	39	10.42611	9.97145	5	27
34	9.54567	33	9.57428	38	10.42572	9.97140	5	26
35	9.54601	34	9.57466	38	10.42534	9.97135	5	25
36	9.54635	33	9.57504	39	10.42496	9.97130	5	24
37	9.54668	34	9.57543	38	10.42457	9.97125	5	23
38	9.54702	33	9.57581	38	10.42419	9.97121	5	22
39	9.54735	34	9.57619	39	10.42381	9.97116	5	21
40	9.54769	33	9.57658	38	10.42342	9.97111	5	20
41	9.54802	34	9.57696	38	10.42304	9.97107	5	19
42	9.54836	33	9.57734	38	10.42266	9.97102	5	18
43	9.54869	34	9.57772	39	10.42228	9.97097	5	17
44	9.54903	33	9.57810	39	10.42190	9.97092	5	16
45	9.54936	33	9.57849	38	10.42151	9.97087	5	15
46	9.54969	34	9.57887	38	10.42113	9.97083	5	14
47	9.55003	33	9.57925	38	10.42075	9.97078	5	13
48	9.55036	33	9.57963	38	10.42037	9.97073	5	12
49	9.55069	33	9.58001	38	10.41999	9.97068	5	11
50	9.55102	34	9.58039	38	10.41961	9.97063	5	10
51	9.55136	33	9.58077	38	10.41923	9.97059	5	9
52	9.55169	33	9.58115	38	10.41885	9.97054	5	8
53	9.55202	33	9.58153	38	10.41847	9.97049	5	7
54	9.55235	33	9.58191	38	10.41809	9.97044	5	6
55	9.55268	33	9.58229	38	10.41771	9.97039	5	5
56	9.55301	33	9.58267	37	10.41733	9.97035	5	4
57	9.55334	33	9.58304	38	10.41696	9.97030	5	3
58	9.55367	33	9.58342	38	10.41658	9.97025	5	2
59	9.55400	33	9.58380	38	10.41620	9.97020	5	1
60	9.55433	33	9.58418	38	10.41582	9.97015	5	0
	Co-line.		Cotang.		Tangent.	Sine.		

[69 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Co-line.	D.	
0	9.51405	35	9.56107	39	10.43893	9.97209	5	60
1	9.51440	35	9.56146	39	10.43854	9.97204	5	59
2	9.51475	35	9.56185	39	10.43815	9.97200	5	58
3	9.51509	34	9.56224	40	10.43776	9.97285	5	57
4	9.51544	34	9.56264	39	10.43736	9.97280	5	56
5	9.51578	35	9.56303	39	10.43697	9.97276	5	55
6	9.51613	34	9.56342	39	10.43658	9.97271	5	54
7	9.51647	35	9.56381	39	10.43619	9.97266	5	53
8	9.51682	34	9.56420	39	10.43580	9.97262	5	52
9	9.51716	35	9.56459	39	10.43541	9.97257	5	51
10	9.51751	34	9.56498	39	10.43502	9.97252	5	50
11	9.51785	34	9.56537	39	10.43463	9.97248	5	49
12	9.51819	35	9.56576	39	10.43424	9.97243	5	48
13	9.51854	34	9.56615	39	10.43385	9.97238	5	47
14	9.51888	34	9.56654	39	10.43346	9.97234	5	46
15	9.51922	35	9.56693	39	10.43307	9.97229	5	45
16	9.51957	34	9.56732	39	10.43268	9.97224	5	44
17	9.51991	34	9.56771	39	10.43229	9.97220	5	43
18	9.52025	34	9.56810	39	10.43190	9.97215	5	42
19	9.52059	34	9.56849	38	10.43151	9.97210	5	41
20	9.52093	34	9.56887	39	10.43113	9.97206	5	40
21	9.52127	34	9.56926	39	10.43074	9.97201	5	39
22	9.52161	34	9.56965	39	10.43035	9.97196	5	38
23	9.52195	34	9.57004	38	10.42996	9.97192	5	37
24	9.52229	34	9.57042	39	10.42958	9.97187	5	36
25	9.52263	34	9.57081	39	10.42919	9.97182	5	35
26	9.52297	34	9.57120	38	10.42880	9.97178	5	34
27	9.52331	34	9.57158	39	10.42842	9.97173	5	33
28	9.52365	34	9.57197	38	10.42803	9.97168	5	32
29	9.52399	34	9.57235	39	10.42765	9.97163	5	31
30	9.52433	34	9.57274	39	10.42726	9.97159	5	30
	Co-line.		Cotang.		Tangent.	Sine.		

[69 degrees.]

[21 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	
0	9°55433	33	9°58418	37	10°41582	9°97015	5	60
1	9°55466	33	9°58455	38	10°41545	9°97010	5	59
2	9°55499	33	9°58493	38	10°41507	9°97005	4	58
3	9°55532	33	9°58530	38	10°41469	9°97001	4	57
4	9°55564	33	9°58566	37	10°41431	9°96996	5	56
5	9°55597	33	9°58606	38	10°41394	9°96991	5	55
6	9°55630	33	9°58644	38	10°41356	9°96986	5	54
7	9°55663	33	9°58681	38	10°41319	9°96981	5	53
8	9°55695	33	9°58719	38	10°41281	9°96976	5	52
9	9°55728	33	9°58757	37	10°41243	9°96971	5	51
10	9°55761	33	9°58794	38	10°41206	9°96966	4	50
11	9°55793	33	9°58832	37	10°41168	9°96961	5	49
12	9°55826	33	9°58869	38	10°41131	9°96957	5	48
13	9°55858	33	9°58907	37	10°41093	9°96952	5	47
14	9°55891	33	9°58944	37	10°41056	9°96947	5	46
15	9°55923	33	9°58981	38	10°41019	9°96942	5	45
16	9°55956	33	9°59019	37	10°40981	9°96937	5	44
17	9°55988	33	9°59056	38	10°40944	9°96932	5	43
18	9°56021	33	9°59094	37	10°40906	9°96927	5	42
19	9°56053	33	9°59131	37	10°40869	9°96922	5	41
20	9°56085	33	9°59168	37	10°40832	9°96917	5	40
21	9°56118	33	9°59205	38	10°40795	9°96912	5	39
22	9°56150	33	9°59243	37	10°40757	9°96907	4	38
23	9°56182	33	9°59280	37	10°40720	9°96902	4	37
24	9°56215	33	9°59317	37	10°40683	9°96898	5	36
25	9°56247	33	9°59354	37	10°40646	9°96893	5	35
26	9°56279	33	9°59391	38	10°40609	9°96888	5	34
27	9°56311	33	9°59429	37	10°40571	9°96883	5	33
28	9°56343	33	9°59466	37	10°40534	9°96878	5	32
29	9°56375	33	9°59503	37	10°40497	9°96873	5	31
30	9°56408	33	9°59540	37	10°40460	9°96868	5	30
	Cosine.		Cotang.		Tangent.	Sine.		

[68 degrees.]

[21 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	
30	9°56408	32	9°59540	37	10°40460	9°96868	5	30
31	9°56440	32	9°59577	37	10°40423	9°96863	5	29
32	9°56472	32	9°59614	37	10°40386	9°96858	5	28
33	9°56504	32	9°59651	37	10°40349	9°96853	5	27
34	9°56536	32	9°59688	37	10°40312	9°96848	5	26
35	9°56568	32	9°59725	37	10°40275	9°96843	5	25
36	9°56599	32	9°59762	37	10°40238	9°96838	5	24
37	9°56631	32	9°59799	36	10°40201	9°96833	5	23
38	9°56663	32	9°59835	37	10°40165	9°96828	5	22
39	9°56695	32	9°59872	37	10°40128	9°96823	5	21
40	9°56727	32	9°59909	37	10°40091	9°96818	5	20
41	9°56759	32	9°59946	37	10°40054	9°96813	5	19
42	9°56790	32	9°59983	36	10°40017	9°96808	5	18
43	9°56822	32	9°60019	37	10°39981	9°96803	5	17
44	9°56854	32	9°60056	37	10°39944	9°96798	5	16
45	9°56886	32	9°60093	37	10°39907	9°96793	5	15
46	9°56917	32	9°60130	36	10°39870	9°96788	5	14
47	9°56949	32	9°60166	37	10°39834	9°96783	5	13
48	9°56980	32	9°60203	37	10°39797	9°96778	5	12
49	9°57012	32	9°60240	36	10°39760	9°96772	5	11
50	9°57044	32	9°60276	37	10°39724	9°96767	5	10
51	9°57075	32	9°60313	36	10°39687	9°96762	5	9
52	9°57107	32	9°60350	37	10°39651	9°96757	5	8
53	9°57138	32	9°60386	36	10°39614	9°96752	5	7
54	9°57169	32	9°60422	37	10°39578	9°96747	5	6
55	9°57201	32	9°60459	36	10°39541	9°96742	5	5
56	9°57232	32	9°60495	37	10°39505	9°96737	5	4
57	9°57264	32	9°60532	36	10°39468	9°96732	5	3
58	9°57295	32	9°60568	37	10°39432	9°96727	5	2
59	9°57326	32	9°60605	36	10°39395	9°96722	5	1
60	9°57358	32	9°60641	37	10°39359	9°96717	5	0
	Cosine.		Cotang.		Tangent.	Sine.		

[68 degrees.]

[22 degrees.]

°	'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	'
0	9° 57' 38	31	9° 6' 641	36	10° 19' 159	9° 96' 717	6	60
1	9° 57' 39	31	9° 6' 677	37	10° 19' 223	9° 96' 711	5	59
2	9° 57' 40	31	9° 6' 674	36	10° 19' 286	9° 96' 706	5	58
3	9° 57' 41	31	9° 6' 670	36	10° 19' 350	9° 96' 701	5	57
4	9° 57' 42	32	9° 6' 678	36	10° 19' 414	9° 96' 696	5	56
5	9° 57' 43	32	9° 6' 683	36	10° 19' 477	9° 96' 691	5	55
6	9° 57' 44	32	9° 6' 689	36	10° 19' 541	9° 96' 686	5	54
7	9° 57' 45	31	9° 6' 685	36	10° 19' 605	9° 96' 681	5	53
8	9° 57' 46	31	9° 6' 693	36	10° 19' 669	9° 96' 676	6	52
9	9° 57' 47	31	9° 6' 697	36	10° 19' 733	9° 96' 671	5	51
10	9° 57' 48	31	9° 6' 701	36	10° 19' 797	9° 96' 666	5	50
11	9° 57' 49	31	9° 6' 704	36	10° 19' 861	9° 96' 661	5	49
12	9° 57' 50	31	9° 6' 708	36	10° 19' 925	9° 96' 656	5	48
13	9° 57' 51	31	9° 6' 712	36	10° 19' 989	9° 96' 651	5	47
14	9° 57' 52	31	9° 6' 716	36	10° 20' 053	9° 96' 646	5	46
15	9° 57' 53	31	9° 6' 719	36	10° 20' 117	9° 96' 641	5	45
16	9° 57' 54	31	9° 6' 723	36	10° 20' 181	9° 96' 636	5	44
17	9° 57' 55	30	9° 6' 726	36	10° 20' 245	9° 96' 631	5	43
18	9° 57' 56	30	9° 6' 729	36	10° 20' 309	9° 96' 626	5	42
19	9° 57' 57	31	9° 6' 732	36	10° 20' 373	9° 96' 621	5	41
20	9° 57' 58	30	9° 6' 735	36	10° 20' 437	9° 96' 616	6	40
21	9° 57' 59	30	9° 6' 738	36	10° 20' 501	9° 96' 611	5	39
22	9° 58' 00	31	9° 6' 741	36	10° 20' 565	9° 96' 606	5	38
23	9° 58' 01	31	9° 6' 744	36	10° 21' 029	9° 96' 601	5	37
24	9° 58' 02	30	9° 6' 747	36	10° 21' 093	9° 96' 596	5	36
25	9° 58' 03	30	9° 6' 750	36	10° 21' 157	9° 96' 591	5	35
26	9° 58' 04	30	9° 6' 753	36	10° 21' 221	9° 96' 586	5	34
27	9° 58' 05	30	9° 6' 756	36	10° 21' 285	9° 96' 581	5	33
28	9° 58' 06	30	9° 6' 759	36	10° 21' 349	9° 96' 576	5	32
29	9° 58' 07	30	9° 6' 762	36	10° 21' 413	9° 96' 571	5	31
30	9° 58' 08	31	9° 6' 765	35	10° 21' 477	9° 96' 566	5	30
'		Cosine.		Cotang.		Tangent.	Sine.	'

[67 degrees.]

[22 degrees.]

°	'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	'
30	9° 58' 24	30	9° 6' 1722	36	10° 32' 28	9° 96' 562	6	30
29	9° 58' 25	31	9° 6' 1758	36	10° 32' 42	9° 96' 556	5	29
28	9° 58' 26	31	9° 6' 1794	36	10° 32' 56	9° 96' 551	5	28
27	9° 58' 27	31	9° 6' 1830	35	10° 33' 10	9° 96' 546	5	27
26	9° 58' 28	31	9° 6' 1865	35	10° 33' 24	9° 96' 541	6	26
25	9° 58' 29	31	9° 6' 1901	35	10° 33' 38	9° 96' 535	5	25
24	9° 58' 30	31	9° 6' 1936	35	10° 33' 52	9° 96' 530	5	24
23	9° 58' 31	30	9° 6' 1972	35	10° 34' 06	9° 96' 525	5	23
22	9° 58' 32	30	9° 6' 2008	35	10° 34' 20	9° 96' 520	6	22
21	9° 58' 33	30	9° 6' 2043	35	10° 34' 34	9° 96' 514	5	21
20	9° 58' 34	30	9° 6' 2079	35	10° 34' 48	9° 96' 509	5	20
19	9° 58' 35	30	9° 6' 2114	35	10° 34' 62	9° 96' 504	6	19
18	9° 58' 36	30	9° 6' 2150	35	10° 34' 76	9° 96' 498	5	18
17	9° 58' 37	31	9° 6' 2185	35	10° 34' 90	9° 96' 493	5	17
16	9° 58' 38	31	9° 6' 2221	35	10° 35' 04	9° 96' 488	5	16
15	9° 58' 39	30	9° 6' 2256	35	10° 35' 18	9° 96' 483	5	15
14	9° 58' 40	30	9° 6' 2292	35	10° 35' 32	9° 96' 477	5	14
13	9° 58' 41	30	9° 6' 2327	35	10° 35' 46	9° 96' 472	5	13
12	9° 58' 42	30	9° 6' 2362	35	10° 35' 60	9° 96' 467	6	12
11	9° 58' 43	30	9° 6' 2398	35	10° 35' 74	9° 96' 461	5	11
10	9° 58' 44	30	9° 6' 2433	35	10° 35' 88	9° 96' 456	5	10
9	9° 58' 45	30	9° 6' 2468	35	10° 35' 102	9° 96' 451	6	9
8	9° 58' 46	30	9° 6' 2504	35	10° 35' 166	9° 96' 445	5	8
7	9° 58' 47	30	9° 6' 2539	35	10° 35' 30	9° 96' 440	5	7
6	9° 58' 48	30	9° 6' 2574	35	10° 35' 44	9° 96' 435	5	6
5	9° 58' 49	30	9° 6' 2609	35	10° 35' 58	9° 96' 429	5	5
4	9° 58' 50	29	9° 6' 2645	35	10° 36' 12	9° 96' 424	5	4
3	9° 58' 51	30	9° 6' 2680	35	10° 36' 26	9° 96' 419	6	3
2	9° 58' 52	30	9° 6' 2715	35	10° 36' 40	9° 96' 413	5	2
1	9° 58' 53	30	9° 6' 2750	35	10° 36' 54	9° 96' 408	5	1
0	9° 58' 54	30	9° 6' 2785	35	10° 37' 08	9° 96' 403	5	0
'		Cosine.		Cotang.		Tangent.	Sine.	'

[67 degrees.]

[23 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Diff.	Cotang.	Co-sine.	D.
30	9.60070	29	9.63830	35	10.36170	35	10.36170	9.96240	30
31	9.60099	29	9.63865	35	10.36185	35	10.36185	9.96244	29
32	9.60128	29	9.63899	35	10.36200	35	10.36200	9.96249	28
33	9.60157	29	9.63934	34	10.36215	34	10.36215	9.96253	27
34	9.60186	29	9.63968	34	10.36230	34	10.36230	9.96257	26
35	9.60215	29	9.64003	34	10.36245	34	10.36245	9.96261	25
36	9.60244	29	9.64037	35	10.36260	35	10.36260	9.96265	24
37	9.60273	29	9.64072	35	10.36275	35	10.36275	9.96269	23
38	9.60302	29	9.64106	34	10.36290	34	10.36290	9.96273	22
39	9.60331	28	9.64140	34	10.36305	34	10.36305	9.96277	21
40	9.60359	29	9.64175	35	10.36320	35	10.36320	9.96281	20
41	9.60388	29	9.64209	34	10.36335	34	10.36335	9.96285	19
42	9.60417	29	9.64243	35	10.36350	35	10.36350	9.96289	18
43	9.60446	28	9.64278	34	10.36365	34	10.36365	9.96293	17
44	9.60474	29	9.64312	34	10.36380	34	10.36380	9.96297	16
45	9.60503	29	9.64346	35	10.36395	35	10.36395	9.96301	15
46	9.60532	29	9.64381	34	10.36410	34	10.36410	9.96305	14
47	9.60561	28	9.64415	34	10.36425	34	10.36425	9.96309	13
48	9.60589	29	9.64449	34	10.36440	34	10.36440	9.96313	12
49	9.60618	28	9.64483	35	10.36455	35	10.36455	9.96317	11
50	9.60646	29	9.64517	35	10.36470	35	10.36470	9.96321	10
51	9.60675	29	9.64552	34	10.36485	34	10.36485	9.96325	9
52	9.60704	28	9.64586	34	10.36500	34	10.36500	9.96329	8
53	9.60732	29	9.64620	34	10.36515	34	10.36515	9.96333	7
54	9.60761	28	9.64654	34	10.36530	34	10.36530	9.96337	6
55	9.60789	29	9.64688	35	10.36545	35	10.36545	9.96341	5
56	9.60818	28	9.64722	34	10.36560	34	10.36560	9.96345	4
57	9.60846	29	9.64756	34	10.36575	34	10.36575	9.96349	3
58	9.60875	28	9.64790	34	10.36590	34	10.36590	9.96353	2
59	9.60903	28	9.64824	34	10.36605	34	10.36605	9.96357	1
60	9.60931	28	9.64858	34	10.36620	34	10.36620	9.96361	0
'	Co-sine.		Co-sine.					Sine.	'

[66 degrees.]

[23 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Diff.	Co-sine.	D.
0	9.59188	30	9.62785	35	10.37215	35	9.96403	60
1	9.59218	29	9.62820	35	10.37180	35	9.96407	59
2	9.59247	30	9.62855	35	10.37145	35	9.96412	58
3	9.59277	30	9.62890	36	10.37110	36	9.96417	57
4	9.59307	29	9.62926	35	10.37074	35	9.96421	56
5	9.59336	30	9.62961	35	10.37039	35	9.96426	55
6	9.59366	30	9.62996	35	10.37004	35	9.96431	54
7	9.59396	29	9.63031	35	10.36969	35	9.96436	53
8	9.59425	30	9.63066	35	10.36934	35	9.96440	52
9	9.59455	29	9.63101	34	10.36899	34	9.96445	51
10	9.59484	30	9.63135	35	10.36865	35	9.96450	50
11	9.59514	29	9.63170	35	10.36830	35	9.96454	49
12	9.59543	30	9.63205	35	10.36795	35	9.96459	48
13	9.59573	29	9.63240	35	10.36760	35	9.96463	47
14	9.59602	30	9.63275	35	10.36725	35	9.96468	46
15	9.59632	29	9.63310	35	10.36690	35	9.96472	45
16	9.59661	29	9.63345	34	10.36655	34	9.96477	44
17	9.59690	30	9.63379	35	10.36621	35	9.96481	43
18	9.59720	29	9.63414	35	10.36586	35	9.96486	42
19	9.59749	29	9.63449	35	10.36551	35	9.96490	41
20	9.59778	30	9.63484	35	10.36516	35	9.96495	40
21	9.59808	29	9.63519	34	10.36481	34	9.96499	39
22	9.59837	29	9.63553	35	10.36447	35	9.96504	38
23	9.59866	29	9.63588	35	10.36412	35	9.96508	37
24	9.59895	29	9.63623	34	10.36377	34	9.96513	36
25	9.59924	30	9.63657	35	10.36343	35	9.96517	35
26	9.59954	29	9.63692	34	10.36308	34	9.96522	34
27	9.59983	29	9.63726	35	10.36274	35	9.96526	33
28	9.60012	29	9.63761	35	10.36239	35	9.96531	32
29	9.60041	29	9.63796	34	10.36204	34	9.96535	31
30	9.60070	29	9.63830	34	10.36170	34	9.96540	30
'	Co-sine.		Co-sine.				Sine.	'

[66 degrees.]



[24 degrees.]

°	'	Sec.	Diff.	Tangent.	Diff.	Colang.	Colang.	Sec.	'
0	9°00'31	29	9°48'28	34	10°35'142	9°06'07	6	60	
1	9°00'32	28	9°48'29	34	10°35'108	9°06'07	5	59	
2	9°00'38	28	9°48'32	34	10°35'074	9°06'06	5	58	
3	9°01'06	28	9°48'36	34	10°35'040	9°06'06	6	57	
4	9°01'05	28	9°48'39	34	10°35'006	9°06'06	5	56	
5	9°01'43	28	9°48'43	34	10°34'972	9°06'05	5	55	
6	9°01'01	28	9°48'46	34	10°34'938	9°06'09	5	54	
7	9°01'29	29	9°48'50	34	10°34'904	9°06'14	5	53	
8	9°01'58	28	9°48'53	34	10°34'870	9°06'28	6	52	
9	9°01'86	28	9°48'56	34	10°34'836	9°06'22	5	51	
10	9°01'24	28	9°48'59	34	10°34'802	9°06'17	5	50	
11	9°01'42	28	9°49'01	34	10°34'769	9°06'11	6	49	
12	9°01'20	28	9°49'05	34	10°34'735	9°06'05	5	48	
13	9°01'28	28	9°49'09	34	10°34'701	9°06'00	5	47	
14	9°01'36	28	9°49'13	34	10°34'667	9°05'54	6	46	
15	9°01'34	28	9°49'16	34	10°34'634	9°05'48	6	45	
16	9°01'32	29	9°49'20	34	10°34'600	9°05'42	6	44	
17	9°01'41	27	9°49'24	33	10°34'566	9°05'37	6	43	
18	9°01'43	28	9°49'27	34	10°34'533	9°05'31	6	42	
19	9°01'46	28	9°49'31	34	10°34'499	9°05'25	5	41	
20	9°01'49	28	9°49'35	33	10°34'465	9°05'20	6	40	
21	9°01'52	28	9°49'38	34	10°34'432	9°05'14	6	39	
22	9°01'50	28	9°49'42	34	10°34'398	9°05'08	6	38	
23	9°01'57	28	9°49'46	33	10°34'364	9°05'02	6	37	
24	9°01'56	28	9°49'50	34	10°34'331	9°04'57	5	36	
25	9°01'60	28	9°49'53	34	10°34'297	9°04'51	6	35	
26	9°01'62	27	9°49'57	34	10°34'264	9°04'45	6	34	
27	9°01'68	28	9°49'60	33	10°34'230	9°04'40	5	33	
28	9°01'71	28	9°49'64	33	10°34'197	9°04'34	6	32	
29	9°01'74	28	9°49'68	33	10°34'163	9°04'28	6	31	
30	9°01'77		9°49'72		10°34'130	9°04'22	6	30	

[65 degrees.]

[24 degrees.]

°	'	Sec.	Diff.	Tangent.	Diff.	Colang.	Colang.	Sec.	'
30	9°51'73	27	9°58'70	34	10°34'130	9°51'00	5	29	
31	9°51'80	28	9°58'74	33	10°34'096	9°50'97	5	28	
32	9°51'82	28	9°58'77	34	10°34'063	9°50'91	6	28	
33	9°51'85	27	9°58'81	34	10°34'029	9°50'85	6	27	
34	9°51'88	27	9°58'84	33	10°33'996	9°50'79	6	26	
35	9°51'91	28	9°58'88	34	10°33'962	9°50'73	6	25	
36	9°51'93	27	9°58'91	33	10°33'929	9°50'68	5	24	
37	9°51'96	27	9°58'94	34	10°33'896	9°50'62	6	23	
38	9°51'99	27	9°58'97	33	10°33'862	9°50'56	6	22	
39	9°52'01	28	9°59'01	33	10°33'829	9°50'50	6	21	
40	9°52'04	28	9°59'04	34	10°33'796	9°50'44	5	20	
41	9°52'07	28	9°59'08	33	10°33'762	9°50'39	6	19	
42	9°52'10	27	9°59'11	34	10°33'729	9°50'33	6	18	
43	9°52'13	28	9°59'14	33	10°33'696	9°50'27	6	17	
44	9°52'15	27	9°59'17	34	10°33'663	9°50'21	6	16	
45	9°52'18	28	9°59'21	34	10°33'629	9°50'15	5	15	
46	9°52'21	27	9°59'24	33	10°33'596	9°50'10	5	14	
47	9°52'24	27	9°59'27	33	10°33'563	9°50'04	6	13	
48	9°52'26	28	9°59'30	34	10°33'530	9°50'00	6	12	
49	9°52'29	27	9°59'33	33	10°33'497	9°50'00	6	11	
50	9°52'33	27	9°59'37	33	10°33'463	9°50'00	6	10	
51	9°52'35	27	9°59'40	33	10°33'430	9°50'00	6	9	
52	9°52'37	27	9°59'43	33	10°33'397	9°50'00	6	8	
53	9°52'40	27	9°59'46	33	10°33'364	9°50'00	6	7	
54	9°52'42	27	9°59'49	33	10°33'331	9°50'00	6	6	
55	9°52'45	27	9°59'52	33	10°33'298	9°50'00	6	5	
56	9°52'48	27	9°59'55	33	10°33'265	9°50'00	6	4	
57	9°52'51	27	9°59'58	33	10°33'232	9°50'00	6	3	
58	9°52'54	28	9°59'61	33	10°33'199	9°50'00	6	2	
59	9°52'57	27	9°59'64	33	10°33'166	9°50'00	5	1	
60	9°52'59	27	9°59'67	33	10°33'133	9°50'00	5	0	

[65 degrees.]

[25 degrees.]

	Sine.	Diaz.	Tangent.	Diaz.	Cotang.	Cosine.	D.	
1	9° 6' 33.98	27	9° 6' 78.50	32	10° 32' 11.50	9° 9' 55.49	6	30
2	9° 6' 34.45	26	9° 6' 78.82	33	10° 32' 11.18	9° 9' 55.43	7	29
3	9° 6' 34.91	25	9° 6' 79.15	34	10° 32' 08.5	9° 9' 55.37	6	28
4	9° 6' 35.37	24	9° 6' 79.47	35	10° 32' 05.1	9° 9' 55.31	5	27
5	9° 6' 35.84	23	9° 6' 79.80	36	10° 32' 02.0	9° 9' 55.25	4	26
6	9° 6' 36.30	22	9° 6' 80.12	37	10° 31' 58.8	9° 9' 55.19	3	25
7	9° 6' 36.77	21	9° 6' 80.44	38	10° 31' 55.6	9° 9' 55.13	2	24
8	9° 6' 37.23	20	9° 6' 80.77	39	10° 31' 52.3	9° 9' 55.07	1	23
9	9° 6' 37.69	19	9° 6' 81.09	40	10° 31' 49.1	9° 9' 55.00	6	22
10	9° 6' 38.16	18	9° 6' 81.42	41	10° 31' 45.8	9° 9' 54.94	5	21
11	9° 6' 38.62	17	9° 6' 81.74	42	10° 31' 42.6	9° 9' 54.88	4	20
12	9° 6' 39.08	16	9° 6' 82.06	43	10° 31' 39.4	9° 9' 54.82	3	19
13	9° 6' 39.54	15	9° 6' 82.39	44	10° 31' 36.2	9° 9' 54.76	2	18
14	9° 6' 39.99	14	9° 6' 82.71	45	10° 31' 33.0	9° 9' 54.70	1	17
15	9° 6' 40.45	13	9° 6' 83.03	46	10° 31' 29.8	9° 9' 54.64	6	16
16	9° 6' 40.91	12	9° 6' 83.36	47	10° 31' 26.6	9° 9' 54.58	5	15
17	9° 6' 41.37	11	9° 6' 83.68	48	10° 31' 23.4	9° 9' 54.52	4	14
18	9° 6' 41.83	10	9° 6' 84.00	49	10° 31' 20.2	9° 9' 54.46	3	13
19	9° 6' 42.29	9	9° 6' 84.32	50	10° 31' 17.0	9° 9' 54.40	2	12
20	9° 6' 42.75	8	9° 6' 84.65	51	10° 31' 13.8	9° 9' 54.34	1	11
21	9° 6' 43.21	7	9° 6' 84.97	52	10° 31' 10.6	9° 9' 54.27	6	10
22	9° 6' 43.67	6	9° 6' 85.29	53	10° 31' 07.4	9° 9' 54.21	5	9
23	9° 6' 44.13	5	9° 6' 85.61	54	10° 31' 04.2	9° 9' 54.15	4	8
24	9° 6' 44.59	4	9° 6' 85.93	55	10° 31' 01.0	9° 9' 54.09	3	7
25	9° 6' 45.05	3	9° 6' 86.26	56	10° 30' 57.8	9° 9' 54.03	2	6
26	9° 6' 45.51	2	9° 6' 86.58	57	10° 30' 54.6	9° 9' 53.97	1	5
27	9° 6' 45.97	1	9° 6' 86.90	58	10° 30' 51.4	9° 9' 53.91	6	4
28	9° 6' 46.43	60	9° 6' 87.22	59	10° 30' 48.2	9° 9' 53.84	5	3
29	9° 6' 46.89	59	9° 6' 87.54	60	10° 30' 45.0	9° 9' 53.78	4	2
30	9° 6' 47.35	58	9° 6' 87.86		10° 30' 41.8	9° 9' 53.72	3	1
			9° 6' 88.18		10° 30' 38.6	9° 9' 53.66	2	0

[64 degrees.]

[25 degrees.]

	Sine.	Diaz.	Tangent.	Diaz.	Cotang.	Cosine.	D.	
1	9° 6' 50.95	27	9° 6' 68.67	60	10° 31' 13.3	9° 9' 57.28	6	59
2	9° 6' 51.41	26	9° 6' 69.00	59	10° 31' 10.0	9° 9' 57.22	7	58
3	9° 6' 51.87	25	9° 6' 69.33	58	10° 31' 06.7	9° 9' 57.16	6	57
4	9° 6' 52.33	24	9° 6' 69.66	57	10° 31' 03.4	9° 9' 57.10	5	56
5	9° 6' 52.79	23	9° 6' 69.99	56	10° 31' 00.1	9° 9' 57.04	4	55
6	9° 6' 53.25	22	9° 6' 70.32	55	10° 30' 56.8	9° 9' 56.98	3	54
7	9° 6' 53.71	21	9° 6' 70.65	54	10° 30' 53.5	9° 9' 56.92	2	53
8	9° 6' 54.17	20	9° 6' 70.98	53	10° 30' 50.2	9° 9' 56.86	1	52
9	9° 6' 54.63	19	9° 6' 71.31	52	10° 30' 46.9	9° 9' 56.80	6	51
10	9° 6' 55.09	18	9° 6' 71.63	51	10° 30' 43.7	9° 9' 56.74	5	50
11	9° 6' 55.55	17	9° 6' 71.96	50	10° 30' 40.4	9° 9' 56.68	4	49
12	9° 6' 56.01	16	9° 6' 72.29	49	10° 30' 37.1	9° 9' 56.62	3	48
13	9° 6' 56.47	15	9° 6' 72.62	48	10° 30' 33.8	9° 9' 56.56	2	47
14	9° 6' 56.93	14	9° 6' 72.95	47	10° 30' 30.5	9° 9' 56.50	1	46
15	9° 6' 57.39	13	9° 6' 73.27	46	10° 30' 27.3	9° 9' 56.44	6	45
16	9° 6' 57.85	12	9° 6' 73.60	45	10° 30' 24.0	9° 9' 56.38	5	44
17	9° 6' 58.31	11	9° 6' 73.93	44	10° 30' 20.7	9° 9' 56.32	4	43
18	9° 6' 58.77	10	9° 6' 74.26	43	10° 30' 17.4	9° 9' 56.26	3	42
19	9° 6' 59.23	9	9° 6' 74.58	42	10° 30' 14.2	9° 9' 56.20	2	41
20	9° 6' 59.69	8	9° 6' 74.91	41	10° 30' 10.9	9° 9' 56.14	1	40
21	9° 6' 60.15	7	9° 6' 75.24	40	10° 30' 07.6	9° 9' 56.08	6	39
22	9° 6' 60.61	6	9° 6' 75.56	39	10° 30' 04.4	9° 9' 56.02	5	38
23	9° 6' 61.07	5	9° 6' 75.89	38	10° 30' 01.1	9° 9' 55.96	4	37
24	9° 6' 61.53	4	9° 6' 76.22	37	10° 29' 57.8	9° 9' 55.90	3	36
25	9° 6' 61.99	3	9° 6' 76.54	36	10° 29' 54.6	9° 9' 55.84	2	35
26	9° 6' 62.45	2	9° 6' 76.87	35	10° 29' 51.3	9° 9' 55.78	1	34
27	9° 6' 62.91	1	9° 6' 77.19	34	10° 29' 48.0	9° 9' 55.72	6	33
28	9° 6' 63.37	60	9° 6' 77.52	33	10° 29' 44.8	9° 9' 55.66	5	32
29	9° 6' 63.83	59	9° 6' 77.84	32	10° 29' 41.5	9° 9' 55.60	4	31
30	9° 6' 64.29	58	9° 6' 78.17	31	10° 29' 38.3	9° 9' 55.54	3	30
			9° 6' 78.50		10° 29' 35.0	9° 9' 55.48	2	29

[64 degrees.]

[26 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	
0	9°6'184	26	9°68818	32	10°31182	9°95366	6	60
1	9°6'420	26	9°68842	32	10°31150	9°95360	6	59
2	9°6'426	26	9°68882	32	10°31118	9°95354	6	58
3	9°6'426	26	9°68914	32	10°31086	9°95348	7	57
4	9°6'428	25	9°68940	32	10°31054	9°95341	7	56
5	9°6'431	26	9°68978	32	10°31022	9°95335	6	55
6	9°6'439	26	9°69010	32	10°30990	9°95329	6	54
7	9°6'442	26	9°69042	32	10°30958	9°95323	6	53
8	9°6'439	26	9°69074	32	10°30926	9°95317	7	52
9	9°6'447	25	9°69106	32	10°30894	9°95310	6	51
10	9°6'442	26	9°69138	32	10°30862	9°95304	6	50
11	9°6'448	26	9°69170	32	10°30830	9°95298	6	49
12	9°6'449	25	9°69202	32	10°30798	9°95292	6	48
13	9°6'451	26	9°69234	32	10°30766	9°95286	7	47
14	9°6'454	26	9°69266	32	10°30734	9°95279	6	46
15	9°6'457	25	9°69298	31	10°30702	9°95273	6	45
16	9°6'456	26	9°69329	32	10°30671	9°95267	6	44
17	9°6'462	25	9°69361	32	10°30639	9°95261	7	43
18	9°6'467	26	9°69393	32	10°30607	9°95254	6	42
19	9°6'467	25	9°69425	32	10°30575	9°95248	6	41
20	9°6'468	26	9°69457	31	10°30543	9°95242	6	40
21	9°6'474	25	9°69488	31	10°30512	9°95236	7	39
22	9°6'479	26	9°69520	32	10°30480	9°95229	7	38
23	9°6'475	25	9°69552	32	10°30448	9°95223	6	37
24	9°6'480	26	9°69584	31	10°30416	9°95217	6	36
25	9°6'482	25	9°69615	32	10°30385	9°95211	7	35
26	9°6'485	26	9°69647	32	10°30353	9°95204	6	34
27	9°6'487	25	9°69679	31	10°30321	9°95198	6	33
28	9°6'490	25	9°69710	32	10°30290	9°95192	7	32
29	9°6'492	26	9°69742	32	10°30258	9°95185	7	31
30	9°6'495	26	9°69774	32	10°30226	9°95179	7	30
	Cosine.	Cotang.	Diff.	Tangent.	Cotang.	Sine.		

[63 degrees.]

[26 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	
30	9°6'495	25	9°69774	31	10°30226	9°95179	6	30
31	9°6'497	25	9°69805	32	10°30195	9°95173	6	29
32	9°6'500	26	9°69837	31	10°30163	9°95167	6	28
33	9°6'502	25	9°69868	32	10°30132	9°95160	7	27
34	9°6'504	25	9°69900	32	10°30100	9°95154	6	26
35	9°6'507	25	9°69932	31	10°30068	9°95148	6	25
36	9°6'510	26	9°69963	32	10°30037	9°95141	7	24
37	9°6'513	25	9°69995	31	10°30005	9°95135	6	23
38	9°6'515	25	9°70026	32	10°29974	9°95129	7	22
39	9°6'518	25	9°70058	32	10°29942	9°95122	6	21
40	9°6'520	25	9°70089	31	10°29911	9°95116	6	20
41	9°6'523	25	9°70121	32	10°29879	9°95110	7	19
42	9°6'525	26	9°70152	31	10°29848	9°95103	6	18
43	9°6'528	25	9°70184	32	10°29816	9°95097	7	17
44	9°6'530	25	9°70215	32	10°29785	9°95090	6	16
45	9°6'531	25	9°70247	31	10°29753	9°95084	6	15
46	9°6'536	25	9°70278	32	10°29722	9°95078	6	14
47	9°6'538	25	9°70309	32	10°29691	9°95071	6	13
48	9°6'540	25	9°70341	31	10°29659	9°95065	6	12
49	9°6'543	25	9°70372	32	10°29628	9°95059	7	11
50	9°6'546	25	9°70404	31	10°29596	9°95052	6	10
51	9°6'548	25	9°70435	32	10°29565	9°95046	7	9
52	9°6'549	25	9°70466	31	10°29534	9°95039	6	8
53	9°6'551	25	9°70498	32	10°29502	9°95033	6	7
54	9°6'556	24	9°70529	31	10°29471	9°95027	6	6
55	9°6'558	25	9°70560	32	10°29440	9°95020	7	5
56	9°6'560	25	9°70592	31	10°29408	9°95014	7	4
57	9°6'561	25	9°70623	32	10°29377	9°95007	7	3
58	9°6'565	25	9°70654	31	10°29346	9°95001	6	2
59	9°6'568	25	9°70685	32	10°29315	9°94995	7	1
60	9°6'570	25	9°70717	31	10°29283	9°94988	7	0
	Cosine.	Cotang.	Diff.	Tangent.	Cotang.	Sine.		

[63 degrees.]

[27 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Diff.	Cotang.	Co-sine.	'
0	9.66441	24	9.71648	31	10.28352	31	10.28352	9.94793	30
1	9.66445	24	9.71679	30	10.28321	30	10.28321	9.94786	29
2	9.66449	24	9.71709	31	10.28291	31	10.28291	9.94780	28
3	9.66453	24	9.71740	31	10.28260	31	10.28260	9.94773	27
4	9.66457	24	9.71771	31	10.28229	31	10.28229	9.94767	26
5	9.66461	24	9.71802	31	10.28198	31	10.28198	9.94760	25
6	9.66465	24	9.71833	30	10.28167	30	10.28167	9.94753	24
7	9.66469	24	9.71864	31	10.28137	31	10.28137	9.94747	23
8	9.66473	24	9.71894	31	10.28106	31	10.28106	9.94740	22
9	9.66477	24	9.71925	30	10.28075	30	10.28075	9.94734	21
10	9.66481	24	9.71955	31	10.28045	31	10.28045	9.94727	20
11	9.66485	24	9.71986	31	10.28014	31	10.28014	9.94720	19
12	9.66489	24	9.72017	31	10.27983	31	10.27983	9.94714	18
13	9.66493	24	9.72048	30	10.27952	30	10.27952	9.94707	17
14	9.66497	24	9.72078	31	10.27922	31	10.27922	9.94700	16
15	9.66501	24	9.72109	31	10.27891	31	10.27891	9.94694	15
16	9.66505	24	9.72140	30	10.27860	30	10.27860	9.94687	14
17	9.66509	24	9.72170	31	10.27830	31	10.27830	9.94680	13
18	9.66513	24	9.72201	31	10.27799	31	10.27799	9.94674	12
19	9.66517	24	9.72231	31	10.27769	31	10.27769	9.94667	11
20	9.66521	24	9.72262	31	10.27738	31	10.27738	9.94660	10
21	9.66525	24	9.72293	30	10.27707	30	10.27707	9.94654	9
22	9.66529	24	9.72323	31	10.27677	31	10.27677	9.94647	8
23	9.66533	24	9.72354	31	10.27646	31	10.27646	9.94640	7
24	9.66537	24	9.72384	30	10.27616	30	10.27616	9.94634	6
25	9.66541	24	9.72415	31	10.27585	31	10.27585	9.94627	5
26	9.66545	24	9.72445	31	10.27555	31	10.27555	9.94620	4
27	9.66549	24	9.72476	31	10.27524	31	10.27524	9.94614	3
28	9.66553	24	9.72506	30	10.27494	30	10.27494	9.94607	2
29	9.66557	24	9.72537	31	10.27463	31	10.27463	9.94600	1
30	9.66561	24	9.72567	30	10.27433	30	10.27433	9.94593	0
'	Co-sine.		Cotang.		Tangent.		Sine.		'

[62 degrees.]

[27 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Diff.	Cotang.	Co-sine.	'
0	9.65705	24	9.70717	31	10.29283	31	10.29283	9.94988	60
1	9.65709	25	9.70748	31	10.29252	31	10.29252	9.94982	59
2	9.65713	25	9.70779	31	10.29221	31	10.29221	9.94975	58
3	9.65717	25	9.70810	31	10.29190	31	10.29190	9.94969	57
4	9.65721	25	9.70841	31	10.29159	31	10.29159	9.94962	56
5	9.65725	25	9.70873	31	10.29127	31	10.29127	9.94956	55
6	9.65729	25	9.70904	31	10.29096	31	10.29096	9.94949	54
7	9.65733	25	9.70935	31	10.29065	31	10.29065	9.94943	53
8	9.65737	25	9.70966	31	10.29034	31	10.29034	9.94936	52
9	9.65741	25	9.70997	31	10.29003	31	10.29003	9.94930	51
10	9.65745	25	9.71028	31	10.28972	31	10.28972	9.94923	50
11	9.65749	25	9.71059	31	10.28941	31	10.28941	9.94917	49
12	9.65753	25	9.71090	31	10.28910	31	10.28910	9.94911	48
13	9.65757	25	9.71121	31	10.28879	31	10.28879	9.94904	47
14	9.65761	25	9.71153	31	10.28847	31	10.28847	9.94898	46
15	9.65765	25	9.71184	31	10.28816	31	10.28816	9.94891	45
16	9.65769	25	9.71215	31	10.28785	31	10.28785	9.94885	44
17	9.65773	25	9.71246	31	10.28754	31	10.28754	9.94878	43
18	9.65777	25	9.71277	31	10.28723	31	10.28723	9.94871	42
19	9.65781	25	9.71308	31	10.28692	31	10.28692	9.94865	41
20	9.65785	25	9.71339	31	10.28661	31	10.28661	9.94858	40
21	9.65789	25	9.71370	31	10.28630	31	10.28630	9.94852	39
22	9.65793	25	9.71401	30	10.28599	30	10.28599	9.94845	38
23	9.65797	25	9.71432	31	10.28569	31	10.28569	9.94839	37
24	9.65801	25	9.71463	31	10.28538	31	10.28538	9.94832	36
25	9.65805	25	9.71494	31	10.28507	31	10.28507	9.94826	35
26	9.65809	25	9.71525	31	10.28476	31	10.28476	9.94819	34
27	9.65813	25	9.71555	31	10.28445	31	10.28445	9.94813	33
28	9.65817	25	9.71586	31	10.28414	31	10.28414	9.94806	32
29	9.65821	25	9.71617	31	10.28383	31	10.28383	9.94799	31
30	9.65825	25	9.71648	31	10.28352	31	10.28352	9.94793	30
'	Co-sine.		Cotang.		Tangent.		Sine.		'

[62 degrees.]

[28 degrees.]

	Sine.	DIF.	Tangent.	DIF.	Cotang.	Cotina.	D.	
0	9° 6' 161	24	9° 7' 567	31	10° 27' 433	9° 94593	6	60
1	9° 6' 715	24	9° 7' 558	30	10° 27' 402	9° 94580	7	59
2	9° 6' 268	24	9° 7' 548	30	10° 27' 372	9° 94566	7	58
3	9° 6' 322	24	9° 7' 539	31	10° 27' 341	9° 94553	7	57
4	9° 6' 376	24	9° 7' 529	30	10° 27' 311	9° 94539	6	56
5	9° 6' 430	24	9° 7' 519	31	10° 27' 280	9° 94526	7	55
6	9° 6' 483	23	9° 7' 509	30	10° 27' 250	9° 94513	7	54
7	9° 6' 537	23	9° 7' 499	31	10° 27' 220	9° 94500	6	53
8	9° 6' 590	23	9° 7' 489	30	10° 27' 189	9° 94486	7	52
9	9° 6' 644	24	9° 7' 479	31	10° 27' 159	9° 94473	7	51
10	9° 6' 698	24	9° 7' 469	30	10° 27' 128	9° 94459	7	50
11	9° 6' 752	24	9° 7' 459	31	10° 27' 098	9° 94446	6	49
12	9° 6' 806	23	9° 7' 449	30	10° 27' 068	9° 94433	7	48
13	9° 6' 860	23	9° 7' 439	31	10° 27' 037	9° 94420	7	47
14	9° 6' 914	23	9° 7' 429	30	10° 27' 007	9° 94407	7	46
15	9° 6' 968	24	9° 7' 419	31	10° 26' 977	9° 94394	7	45
16	9° 7' 022	24	9° 7' 409	30	10° 26' 946	9° 94381	6	44
17	9° 7' 076	24	9° 7' 399	31	10° 26' 916	9° 94368	7	43
18	9° 7' 130	23	9° 7' 389	30	10° 26' 886	9° 94355	7	42
19	9° 7' 184	23	9° 7' 379	31	10° 26' 856	9° 94342	7	41
20	9° 7' 238	23	9° 7' 369	30	10° 26' 825	9° 94329	7	40
21	9° 7' 292	23	9° 7' 359	31	10° 26' 795	9° 94316	6	39
22	9° 7' 346	23	9° 7' 349	30	10° 26' 765	9° 94303	7	38
23	9° 7' 400	23	9° 7' 339	31	10° 26' 735	9° 94290	7	37
24	9° 7' 454	23	9° 7' 329	30	10° 26' 705	9° 94277	7	36
25	9° 7' 508	23	9° 7' 319	31	10° 26' 674	9° 94264	7	35
26	9° 7' 562	23	9° 7' 309	30	10° 26' 644	9° 94251	7	34
27	9° 8' 016	24	9° 7' 299	31	10° 26' 614	9° 94238	7	33
28	9° 8' 070	24	9° 7' 289	30	10° 26' 584	9° 94225	6	32
29	9° 8' 124	23	9° 7' 279	31	10° 26' 554	9° 94212	7	31
30	9° 8' 178	23	9° 7' 269	30	10° 26' 524	9° 94199	7	30
			Cotang.		Tangent.	Sine.		

[61 degrees.]

[28 degrees.]

	Sine.	DIF.	Tangent.	DIF.	Cotang.	Cotina.	D.	
30	9° 6' 866	34	9° 7' 347	31	10° 26' 524	9° 94390	7	30
31	9° 6' 880	33	9° 7' 337	30	10° 26' 493	9° 94377	7	29
32	9° 6' 893	33	9° 7' 327	30	10° 26' 463	9° 94364	7	28
33	9° 6' 906	33	9° 7' 317	30	10° 26' 433	9° 94351	7	27
34	9° 6' 919	33	9° 7' 307	30	10° 26' 403	9° 94338	6	26
35	9° 6' 932	34	9° 7' 297	30	10° 26' 373	9° 94325	7	25
36	9° 6' 945	34	9° 7' 287	30	10° 26' 343	9° 94312	7	24
37	9° 6' 958	33	9° 7' 277	30	10° 26' 313	9° 94299	7	23
38	9° 6' 971	33	9° 7' 267	30	10° 26' 283	9° 94286	7	22
39	9° 6' 984	33	9° 7' 257	30	10° 26' 253	9° 94273	7	21
40	9° 6' 997	33	9° 7' 247	30	10° 26' 223	9° 94260	7	20
41	9° 7' 010	33	9° 7' 237	30	10° 26' 193	9° 94247	7	19
42	9° 7' 023	33	9° 7' 227	30	10° 26' 163	9° 94234	7	18
43	9° 7' 036	33	9° 7' 217	30	10° 26' 133	9° 94221	7	17
44	9° 7' 049	33	9° 7' 207	30	10° 26' 103	9° 94208	7	16
45	9° 7' 062	34	9° 7' 197	30	10° 26' 073	9° 94195	7	15
46	9° 7' 075	33	9° 7' 187	30	10° 26' 043	9° 94182	7	14
47	9° 7' 088	33	9° 7' 177	30	10° 26' 013	9° 94169	6	13
48	9° 7' 101	33	9° 7' 167	30	10° 25' 983	9° 94156	7	12
49	9° 7' 114	33	9° 7' 157	30	10° 25' 953	9° 94143	7	11
50	9° 7' 127	33	9° 7' 147	30	10° 25' 923	9° 94130	7	10
51	9° 7' 140	33	9° 7' 137	30	10° 25' 893	9° 94117	7	9
52	9° 7' 153	33	9° 7' 127	30	10° 25' 863	9° 94104	7	8
53	9° 7' 166	33	9° 7' 117	30	10° 25' 833	9° 94091	7	7
54	9° 7' 179	33	9° 7' 107	30	10° 25' 803	9° 94078	7	6
55	9° 7' 192	33	9° 7' 097	30	10° 25' 773	9° 94065	7	5
56	9° 7' 205	33	9° 7' 087	30	10° 25' 743	9° 94052	7	4
57	9° 7' 218	33	9° 7' 077	30	10° 25' 713	9° 94039	7	3
58	9° 7' 231	33	9° 7' 067	30	10° 25' 683	9° 94026	7	2
59	9° 7' 244	33	9° 7' 057	30	10° 25' 653	9° 94013	7	1
60	9° 7' 257	33	9° 7' 047	30	10° 25' 623	9° 94000	7	0
			Cotang.		Tangent.	Sine.		

[61 degrees.]

[29 degrees.]

°	Sine.	Diff.	Tangent.	Dial.	Cotang.	Cotang.	Diff.	Sine.	Cotang.	Tangent.	Diff.	Sine.	Cotang.	Tangent.	Diff.	°
30	9°58'557	23	9°74'375	30	10°2'5625	9°94'182	7	60	30	9°62'434	22	30	9°62'434	22	30	9°58'557
31	9°58'580	23	9°74'405	30	10°2'5595	9°94'175	7	59	31	9°62'466	22	31	9°62'466	22	31	9°58'580
32	9°58'603	23	9°74'435	30	10°2'5565	9°94'168	7	58	32	9°62'497	22	32	9°62'497	22	32	9°58'603
33	9°58'625	23	9°74'465	30	10°2'5535	9°94'161	7	57	33	9°62'528	22	33	9°62'528	22	33	9°58'625
34	9°58'648	23	9°74'494	30	10°2'5506	9°94'154	7	56	34	9°62'559	22	34	9°62'559	22	34	9°58'648
35	9°58'671	23	9°74'524	30	10°2'5476	9°94'147	7	55	35	9°62'590	22	35	9°62'590	22	35	9°58'671
36	9°58'694	23	9°74'554	30	10°2'5446	9°94'140	7	54	36	9°63'021	22	36	9°63'021	22	36	9°58'694
37	9°58'716	23	9°74'583	30	10°2'5417	9°94'133	7	53	37	9°63'052	22	37	9°63'052	22	37	9°58'716
38	9°58'739	23	9°74'613	30	10°2'5387	9°94'126	7	52	38	9°63'083	22	38	9°63'083	22	38	9°58'739
39	9°58'762	23	9°74'643	30	10°2'5357	9°94'119	7	51	39	9°63'114	22	39	9°63'114	22	39	9°58'762
40	9°58'784	23	9°74'673	30	10°2'5327	9°94'112	7	50	40	9°63'145	22	40	9°63'145	22	40	9°58'784
41	9°58'807	23	9°74'702	30	10°2'5298	9°94'105	7	49	41	9°63'176	22	41	9°63'176	22	41	9°58'807
42	9°58'829	23	9°74'732	30	10°2'5268	9°94'098	8	48	42	9°63'207	22	42	9°63'207	22	42	9°58'829
43	9°58'852	23	9°74'762	30	10°2'5238	9°94'090	8	47	43	9°63'238	22	43	9°63'238	22	43	9°58'852
44	9°58'875	23	9°74'791	30	10°2'5209	9°94'083	7	46	44	9°63'269	22	44	9°63'269	22	44	9°58'875
45	9°58'897	23	9°74'821	30	10°2'5179	9°94'076	7	45	45	9°63'300	22	45	9°63'300	22	45	9°58'897
46	9°58'920	23	9°74'851	30	10°2'5149	9°94'068	7	44	46	9°63'331	22	46	9°63'331	22	46	9°58'920
47	9°58'943	23	9°74'880	30	10°2'5120	9°94'061	7	43	47	9°63'362	22	47	9°63'362	22	47	9°58'943
48	9°58'965	23	9°74'910	30	10°2'5090	9°94'055	7	42	48	9°63'393	22	48	9°63'393	22	48	9°58'965
49	9°58'987	23	9°74'939	30	10°2'5061	9°94'048	7	41	49	9°63'424	22	49	9°63'424	22	49	9°58'987
50	9°59'010	23	9°74'969	30	10°2'5031	9°94'041	7	40	50	9°63'455	22	50	9°63'455	22	50	9°59'010
51	9°59'032	23	9°74'998	30	10°2'5002	9°94'034	7	39	51	9°63'486	22	51	9°63'486	22	51	9°59'032
52	9°59'055	23	9°75'028	30	10°2'4972	9°94'027	7	38	52	9°63'517	22	52	9°63'517	22	52	9°59'055
53	9°59'077	23	9°75'058	30	10°2'4942	9°94'020	8	37	53	9°63'548	22	53	9°63'548	22	53	9°59'077
54	9°59'100	23	9°75'087	30	10°2'4913	9°94'012	7	36	54	9°63'579	22	54	9°63'579	22	54	9°59'100
55	9°59'122	23	9°75'117	30	10°2'4883	9°94'005	7	35	55	9°63'610	22	55	9°63'610	22	55	9°59'122
56	9°59'144	23	9°75'146	30	10°2'4854	9°93'998	7	34	56	9°63'641	22	56	9°63'641	22	56	9°59'144
57	9°59'167	23	9°75'176	30	10°2'4824	9°93'991	7	33	57	9°63'672	22	57	9°63'672	22	57	9°59'167
58	9°59'189	23	9°75'205	30	10°2'4795	9°93'984	7	32	58	9°63'703	22	58	9°63'703	22	58	9°59'189
59	9°59'212	23	9°75'235	30	10°2'4765	9°93'977	7	31	59	9°63'734	22	59	9°63'734	22	59	9°59'212
60	9°59'234	23	9°75'264	30	10°2'4736	9°93'970	7	30	60	9°63'765	22	60	9°63'765	22	60	9°59'234
°	Contin.				Tangent.	Sine.										°

[29 degrees.]

°	Sine.	Diff.	Tangent.	Dial.	Cotang.	Cotang.	Diff.	Sine.	Cotang.	Tangent.	Diff.	Sine.	Cotang.	Tangent.	Diff.	°	
60	9°58'557	23	9°74'375	30	10°2'5625	9°94'182	7	60	30	9°62'434	22	60	30	9°62'434	22	60	9°58'557
59	9°58'580	23	9°74'405	30	10°2'5595	9°94'175	7	59	31	9°62'466	22	59	31	9°62'466	22	59	9°58'580
58	9°58'603	23	9°74'435	30	10°2'5565	9°94'168	7	58	32	9°62'497	22	58	32	9°62'497	22	58	9°58'603
57	9°58'625	23	9°74'465	30	10°2'5535	9°94'161	7	57	33	9°62'528	22	57	33	9°62'528	22	57	9°58'625
56	9°58'648	23	9°74'494	30	10°2'5506	9°94'154	7	56	34	9°62'559	22	56	34	9°62'559	22	56	9°58'648
55	9°58'671	23	9°74'524	30	10°2'5476	9°94'147	7	55	35	9°62'590	22	55	35	9°62'590	22	55	9°58'671
54	9°58'694	23	9°74'554	30	10°2'5446	9°94'140	7	54	36	9°63'021	22	54	36	9°63'021	22	54	9°58'694
53	9°58'716	23	9°74'583	30	10°2'5417	9°94'133	7	53	37	9°63'052	22	53	37	9°63'052	22	53	9°58'716
52	9°58'739	23	9°74'613	30	10°2'5387	9°94'126	7	52	38	9°63'083	22	52	38	9°63'083	22	52	9°58'739
51	9°58'762	23	9°74'643	30	10°2'5357	9°94'119	7	51	39	9°63'114	22	51	39	9°63'114	22	51	9°58'762
50	9°58'784	23	9°74'673	30	10°2'5327	9°94'112	7	50	40	9°63'145	22	50	40	9°63'145	22	50	9°58'784
49	9°58'807	23	9°74'702	30	10°2'5298	9°94'105	7	49	41	9°63'176	22	49	41	9°63'176	22	49	9°58'807
48	9°58'829	23	9°74'732	30	10°2'5268	9°94'098	8	48	42	9°63'207	22	48	42	9°63'207	22	48	9°58'829
47	9°58'852	23	9°74'762	30	10°2'5238	9°94'090	8	47	43	9°63'238	22	47	43	9°63'238	22	47	9°58'852
46	9°58'875	23	9°74'791	30	10°2'5209	9°94'083	7	46	44	9°63'269	22	46	44	9°63'269	22	46	9°58'875
45	9°58'897	23	9°74'821	30	10°2'5179	9°94'076	7	45	45	9°63'300	22	45	45	9°63'300	22	45	9°58'897
44	9°58'920	23	9°74'851	30	10°2'5149	9°94'068	7	44	46	9°63'331	22	44	46	9°63'331	22	44	9°58'920
43	9°58'943	23	9°74'880	30	10°2'5120	9°94'061	7	43	47	9°63'362	22	43	47	9°63'362	22	43	9°58'943
42	9°58'965	23	9°74'910	30	10°2'5090	9°94'055	7	42	48	9°63'393	22	42	48	9°63'393	22	42	9°58'965
41	9°58'987	23	9°74'939	30	10°2'5061	9°94'048	7	41	49	9°63'424	22	41	49	9°63'424	22	41	9°58'987
40	9°59'010	23	9°74'969	30	10°2'5031	9°94'041	7	40	50	9°63'455	22	40	50	9°63'455	22	40	9°59'010
39	9°59'032	23	9°74'998	30	10°2'5002	9°94'034	7	39	51	9°63'486	22	39	51	9°63'486	22	39	9°59'032
38	9°59'055	23	9°75'028	30	10°2'4972	9°94'027	7	38	52	9°63'517	22	38	52	9°63'517	22	38	9°59'055
37	9°59'077	23	9°75'058	30	10°2'4942	9°94'020	8	37	53	9°63'548	22	37	53	9°63'548	22	37	9°59'077
36	9°59'100	23	9°75'087	30	10°2'4913	9°94'012	7	36	54	9°63'579	22	36	54	9°63'579	22	36	9°59'100
35	9°59'122	23	9°75'117	30	10°2'4883	9°94'005	7	35	55	9°63'610	22	35	55	9°63'610	22	35	9°59'122
34	9°59'144	23	9°75'146	30	10°2'4854	9°93'998	7	34	56	9°63'641	22	34	56	9°63'641	22	34	9°59'144
33	9°59'167	23	9°75'176	30	10°2'4824	9°93'991	7	33	57	9°63'672	22	33	57	9°63'672	22	33	9°59'167
32	9°59'189	23	9°75'205	30	10°2'4795	9°93'984	7	32	58	9°63'703	22	32	58	9°63'703	22	32	9°59'189
31	9°59'212	23	9°75'235	30	10°2'4765	9°93'977	7	31	59	9°63'734	22	31	59	9°63'734	22	31	9°59'212
30	9°59'234	23	9°75'264	30	10°2'4736	9°93'970	7	30	60	9°63'765	22	30	60	9°63'765	22	30	9°59'234
°	Contin.				Tangent.	Sine.										°	

[60 degrees.]

[30 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	
0	9'6987	22	9'76144	29	10'23856	9'93753	60	
1	9'69919	22	9'76172	29	10'23827	9'93746	7	8
2	9'69941	22	9'76202	29	10'23798	9'93738	58	
3	9'69963	22	9'76231	29	10'23769	9'93731	7	57
4	9'69984	22	9'76261	30	10'23739	9'93724	7	56
5	9'70006	22	9'76290	29	10'23710	9'93717	7	55
6	9'70028	22	9'76319	29	10'23681	9'93709	8	54
7	9'70049	22	9'76348	29	10'23652	9'93702	7	53
8	9'70072	22	9'76377	29	10'23623	9'93695	7	52
9	9'70093	22	9'76406	29	10'23594	9'93687	8	51
10	9'70115	22	9'76435	29	10'23565	9'93680	7	50
11	9'70137	22	9'76464	29	10'23536	9'93673	7	49
12	9'70159	22	9'76493	29	10'23507	9'93665	8	48
13	9'70180	22	9'76522	29	10'23478	9'93658	7	47
14	9'70202	22	9'76551	29	10'23449	9'93650	8	46
15	9'70224	22	9'76580	29	10'23420	9'93643	7	45
16	9'70245	22	9'76609	30	10'23391	9'93636	8	44
17	9'70267	22	9'76639	29	10'23361	9'93628	7	43
18	9'70288	22	9'76668	29	10'23332	9'93621	7	42
19	9'70310	22	9'76697	28	10'23303	9'93614	8	41
20	9'70332	22	9'76725	29	10'23275	9'93606	8	40
21	9'70353	22	9'76754	29	10'23246	9'93599	7	39
22	9'70375	22	9'76782	29	10'23217	9'93591	8	38
23	9'70396	22	9'76812	29	10'23188	9'93584	7	37
24	9'70418	22	9'76841	29	10'23159	9'93577	8	36
25	9'70439	22	9'76870	29	10'23130	9'93569	7	35
26	9'70461	22	9'76899	29	10'23101	9'93562	8	34
27	9'70482	22	9'76928	29	10'23072	9'93554	7	33
28	9'70504	22	9'76957	29	10'23043	9'93547	8	32
29	9'70525	22	9'76986	29	10'23014	9'93539	7	31
30	9'70547	22	9'77015	29	10'22985	9'93532	8	30
	Cosine.	Cotang.	Tangent.	Diff.	Cotang.	Cosine.		

[59 degrees.]

[30 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	
30	9'70547	22	9'77015	29	10'22985	9'93532	30	
31	9'70568	22	9'77044	29	10'22956	9'93525	7	29
32	9'70590	22	9'77073	28	10'22927	9'93517	8	28
33	9'70611	22	9'77101	29	10'22899	9'93510	7	27
34	9'70633	22	9'77130	29	10'22870	9'93502	8	26
35	9'70654	22	9'77159	29	10'22841	9'93495	7	25
36	9'70675	22	9'77188	29	10'22812	9'93487	8	24
37	9'70697	22	9'77217	29	10'22783	9'93480	7	23
38	9'70718	22	9'77246	28	10'22754	9'93472	8	22
39	9'70739	22	9'77274	29	10'22726	9'93465	7	21
40	9'70761	22	9'77303	29	10'22697	9'93457	8	20
41	9'70782	22	9'77332	29	10'22668	9'93450	7	19
42	9'70803	22	9'77361	29	10'22639	9'93442	8	18
43	9'70824	22	9'77390	28	10'22610	9'93435	7	17
44	9'70846	22	9'77418	29	10'22582	9'93427	8	16
45	9'70867	22	9'77447	29	10'22553	9'93420	7	15
46	9'70888	22	9'77476	29	10'22524	9'93412	8	14
47	9'70909	22	9'77505	28	10'22495	9'93405	7	13
48	9'70931	22	9'77533	29	10'22467	9'93397	8	12
49	9'70952	22	9'77562	29	10'22438	9'93390	7	11
50	9'70973	22	9'77591	28	10'22409	9'93382	8	10
51	9'70994	22	9'77619	29	10'22381	9'93375	7	9
52	9'71015	22	9'77648	29	10'22352	9'93367	8	8
53	9'71036	22	9'77677	29	10'22323	9'93360	7	7
54	9'71058	22	9'77706	28	10'22294	9'93352	8	6
55	9'71079	22	9'77734	29	10'22266	9'93344	7	5
56	9'71100	22	9'77763	28	10'22237	9'93337	8	4
57	9'71121	22	9'77791	29	10'22209	9'93329	7	3
58	9'71142	22	9'77820	29	10'22180	9'93322	8	2
59	9'71163	22	9'77849	28	10'22151	9'93314	7	1
60	9'71184	22	9'77877	28	10'22123	9'93307	8	0
	Cosine.	Cotang.	Tangent.	Diff.	Cotang.	Sine.		

[59 degrees.]

[31 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Diff.	Cotang.	Diff.	
30	9.71809	20	9.78732	28	10.21268	9.93077	8	30	
31	9.71829	21	9.78760	29	10.21240	9.93069	8	29	
32	9.71850	20	9.78789	28	10.21211	9.93061	8	28	
33	9.71870	21	9.78817	29	10.21183	9.93053	8	27	
34	9.71891	21	9.78845	29	10.21155	9.93046	7	26	
35	9.71911	21	9.78874	28	10.21126	9.93038	8	25	
36	9.71932	20	9.78902	28	10.21098	9.93030	8	24	
37	9.71952	21	9.78930	29	10.21070	9.93022	8	23	
38	9.71973	21	9.78959	28	10.21041	9.93014	8	22	
39	9.71994	20	9.78987	28	10.21013	9.93007	7	21	
40	9.72014	20	9.79015	28	10.20985	9.92999	8	20	
41	9.72034	21	9.79043	29	10.20957	9.92991	8	19	
42	9.72055	20	9.79072	28	10.20928	9.92983	8	18	
43	9.72075	21	9.79100	28	10.20900	9.92976	8	17	
44	9.72096	20	9.79128	28	10.20872	9.92968	8	16	
45	9.72116	21	9.79156	29	10.20844	9.92960	8	15	
46	9.72137	20	9.79185	28	10.20815	9.92952	8	14	
47	9.72157	20	9.79213	28	10.20787	9.92944	8	13	
48	9.72177	21	9.79241	29	10.20759	9.92936	8	12	
49	9.72198	20	9.79269	28	10.20731	9.92929	8	11	
50	9.72218	20	9.79297	29	10.20703	9.92921	8	10	
51	9.72238	21	9.79326	28	10.20674	9.92913	8	9	
52	9.72259	20	9.79354	28	10.20646	9.92905	8	8	
53	9.72279	20	9.79382	28	10.20618	9.92897	8	7	
54	9.72299	21	9.79410	29	10.20590	9.92889	8	6	
55	9.72320	20	9.79438	28	10.20562	9.92881	8	5	
56	9.72340	20	9.79466	29	10.20534	9.92874	8	4	
57	9.72360	21	9.79495	28	10.20505	9.92866	8	3	
58	9.72381	20	9.79523	28	10.20477	9.92858	8	2	
59	9.72401	20	9.79551	28	10.20449	9.92850	8	1	
60	9.72421		9.79579		10.20421	9.92841	8	0	
			Cotang.		Tangent.	Sine.			

[58 degrees.]

[31 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Diff.	Cotang.	Diff.	
0	9.71184	21	9.77877	29	10.22123	9.93307	8	60	
1	9.71205	21	9.77906	29	10.22094	9.93299	8	59	
2	9.71226	21	9.77935	28	10.22065	9.93291	8	58	
3	9.71247	21	9.77963	28	10.22037	9.93284	8	57	
4	9.71268	21	9.77992	28	10.22008	9.93276	8	56	
5	9.71289	21	9.78020	29	10.21980	9.93269	7	55	
6	9.71310	21	9.78049	29	10.21951	9.93261	8	54	
7	9.71331	21	9.78077	29	10.21923	9.93253	8	53	
8	9.71352	21	9.78106	29	10.21894	9.93246	8	52	
9	9.71373	20	9.78135	28	10.21865	9.93238	8	51	
10	9.71393	21	9.78163	29	10.21837	9.93230	8	50	
11	9.71414	21	9.78192	28	10.21808	9.93223	8	49	
12	9.71435	21	9.78220	29	10.21780	9.93215	8	48	
13	9.71456	21	9.78249	28	10.21751	9.93207	7	47	
14	9.71477	21	9.78277	29	10.21723	9.93200	8	46	
15	9.71498	21	9.78306	28	10.21694	9.93192	8	45	
16	9.71519	20	9.78334	29	10.21666	9.93184	8	44	
17	9.71539	21	9.78363	28	10.21637	9.93177	8	43	
18	9.71560	21	9.78391	28	10.21609	9.93169	8	42	
19	9.71581	21	9.78419	29	10.21581	9.93161	8	41	
20	9.71602	20	9.78448	28	10.21552	9.93154	8	40	
21	9.71622	21	9.78476	29	10.21524	9.93146	8	39	
22	9.71643	21	9.78505	28	10.21495	9.93138	8	38	
23	9.71664	21	9.78533	29	10.21467	9.93131	8	37	
24	9.71685	20	9.78562	28	10.21438	9.93123	8	36	
25	9.71705	21	9.78590	29	10.21410	9.93115	8	35	
26	9.71726	21	9.78618	28	10.21382	9.93108	8	34	
27	9.71747	20	9.78647	29	10.21353	9.93100	8	33	
28	9.71767	21	9.78675	28	10.21325	9.93092	8	32	
29	9.71788	21	9.78704	28	10.21296	9.93084	8	31	
30	9.71809		9.78732		10.21268	9.93077	7	30	
			Cotang.		Tangent.	Sine.			

[58 degrees.]



[32 degrees.]

	Sine.	Dif.	Tangent.	Dif.	Cotang.	Cosine.	D.	
0	9.74411	20	9.79779	28	10.20421	9.92842	60	
1	9.74441	20	9.79807	28	10.20393	9.92844	59	
2	9.74461	21	9.79835	28	10.20365	9.92846	58	
3	9.74482	20	9.79863	28	10.20337	9.92848	57	
4	9.74502	20	9.79891	28	10.20309	9.92850	56	
5	9.74522	20	9.79919	28	10.20281	9.92852	55	
6	9.74542	20	9.79947	29	10.20253	9.92854	54	
7	9.74562	20	9.79975	28	10.20224	9.92856	53	
8	9.74582	20	9.79986	28	10.20196	9.92858	52	
9	9.74602	20	9.79812	28	10.20168	9.92860	51	
10	9.74622	21	9.79860	28	10.20140	9.92862	50	
11	9.74643	20	9.79888	28	10.20112	9.92864	49	
12	9.74663	20	9.79916	28	10.20084	9.92866	48	
13	9.74683	20	9.79944	28	10.20056	9.92868	47	
14	9.74703	20	9.79972	28	10.20028	9.92870	46	
15	9.74723	20	9.80000	28	10.20000	9.92872	45	
16	9.74743	20	9.80028	28	10.19972	9.92874	44	
17	9.74763	20	9.80056	28	10.19944	9.92876	43	
18	9.74783	20	9.80084	28	10.19916	9.92878	42	
19	9.74803	20	9.80112	28	10.19888	9.92880	41	
20	9.74823	20	9.80140	28	10.19860	9.92882	40	
21	9.74843	20	9.80168	28	10.19832	9.92884	39	
22	9.74863	20	9.80195	28	10.19805	9.92886	38	
23	9.74883	19	9.80223	28	10.19777	9.92888	37	
24	9.74902	20	9.80251	28	10.19749	9.92890	36	
25	9.74922	20	9.80279	28	10.19721	9.92892	35	
26	9.74942	20	9.80307	28	10.19693	9.92894	34	
27	9.74962	20	9.80335	28	10.19665	9.92896	33	
28	9.74982	20	9.80363	28	10.19637	9.92898	32	
29	9.75002	20	9.80391	28	10.19609	9.92900	31	
30	9.75022	20	9.80419	28	10.19581	9.92902	30	

[57 degrees.]

[32 degrees.]

	Sine.	Dif.	Tangent.	Dif.	Cotang.	Cosine.	D.	
30	9.73022	19	9.80419	28	10.19581	9.92863	30	
31	9.73041	20	9.80447	27	10.19553	9.92865	29	
32	9.73061	20	9.80474	28	10.19526	9.92867	28	
33	9.73081	20	9.80502	28	10.19498	9.92869	27	
34	9.73101	20	9.80530	28	10.19470	9.92871	26	
35	9.73121	19	9.80558	28	10.19442	9.92873	25	
36	9.73140	20	9.80586	28	10.19414	9.92875	24	
37	9.73160	20	9.80614	28	10.19386	9.92877	23	
38	9.73180	20	9.80642	27	10.19358	9.92879	22	
39	9.73200	19	9.80669	28	10.19331	9.92881	21	
40	9.73219	20	9.80697	28	10.19303	9.92883	20	
41	9.73239	20	9.80725	28	10.19275	9.92885	19	
42	9.73259	19	9.80753	28	10.19247	9.92887	18	
43	9.73278	20	9.80781	27	10.19219	9.92889	17	
44	9.73298	20	9.80808	28	10.19192	9.92891	16	
45	9.73318	19	9.80836	28	10.19164	9.92893	15	
46	9.73337	20	9.80864	28	10.19136	9.92895	14	
47	9.73357	20	9.80892	27	10.19108	9.92897	13	
48	9.73377	19	9.80919	28	10.19081	9.92899	12	
49	9.73396	20	9.80947	28	10.19053	9.92901	11	
50	9.73416	19	9.80975	28	10.19025	9.92903	10	
51	9.73435	20	9.81003	27	10.18997	9.92905	9	
52	9.73455	20	9.81030	28	10.18970	9.92907	8	
53	9.73474	20	9.81058	28	10.18942	9.92909	7	
54	9.73494	19	9.81086	27	10.18914	9.92911	6	
55	9.73513	20	9.81113	28	10.18887	9.92913	5	
56	9.73533	19	9.81141	28	10.18859	9.92915	4	
57	9.73552	20	9.81169	27	10.18831	9.92917	3	
58	9.73572	19	9.81196	28	10.18804	9.92919	2	
59	9.73591	20	9.81224	28	10.18776	9.92921	1	
60	9.73611	20	9.81252	28	10.18748	9.92923	0	

[57 degrees.]

[33 degrees.]

	Sine.	Diff.	Tangent.	Coang.	Cotang.	D.	
0	9° 7' 56.11	19	9° 8' 12.52	10° 18' 48	9° 9' 33.59	8	60
1	9° 7' 55.50	20	9° 8' 12.79	10° 18' 21	9° 9' 33.51	8	59
2	9° 7' 55.00	19	9° 8' 13.07	10° 18' 693	9° 9' 33.43	8	58
3	9° 7' 53.69	20	9° 8' 13.35	10° 18' 66	9° 9' 33.35	8	57
4	9° 7' 52.89	19	9° 8' 13.62	10° 18' 638	9° 9' 33.26	8	56
5	9° 7' 52.08	19	9° 8' 13.90	10° 18' 610	9° 9' 33.18	8	55
6	9° 7' 51.27	20	9° 8' 14.18	10° 18' 582	9° 9' 33.10	8	54
7	9° 7' 50.46	19	9° 8' 14.45	10° 18' 555	9° 9' 33.02	9	53
8	9° 7' 50.00	19	9° 8' 14.73	10° 18' 527	9° 9' 32.93	9	52
9	9° 7' 49.58	20	9° 8' 15.00	10° 18' 500	9° 9' 32.85	8	51
10	9° 7' 49.15	19	9° 8' 15.28	10° 18' 472	9° 9' 32.77	8	50
11	9° 7' 48.74	19	9° 8' 15.56	10° 18' 444	9° 9' 32.69	9	49
12	9° 7' 48.33	20	9° 8' 15.83	10° 18' 417	9° 9' 32.60	9	48
13	9° 7' 47.93	19	9° 8' 16.11	10° 18' 389	9° 9' 32.52	8	47
14	9° 7' 47.52	19	9° 8' 16.38	10° 18' 362	9° 9' 32.44	9	46
15	9° 7' 47.12	20	9° 8' 16.66	10° 18' 334	9° 9' 32.35	8	45
16	9° 7' 46.72	19	9° 8' 16.93	10° 18' 307	9° 9' 32.27	8	44
17	9° 7' 46.32	19	9° 8' 17.21	10° 18' 279	9° 9' 32.19	8	43
18	9° 7' 45.92	20	9° 8' 17.48	10° 18' 252	9° 9' 32.11	9	42
19	9° 7' 45.52	19	9° 8' 17.76	10° 18' 224	9° 9' 32.02	9	41
20	9° 7' 45.12	19	9° 8' 18.03	10° 18' 197	9° 9' 31.94	8	40
21	9° 7' 44.72	20	9° 8' 18.31	10° 18' 169	9° 9' 31.86	9	39
22	9° 7' 44.32	19	9° 8' 18.58	10° 18' 142	9° 9' 31.77	8	38
23	9° 7' 43.92	19	9° 8' 18.86	10° 18' 114	9° 9' 31.69	8	37
24	9° 7' 43.52	20	9° 8' 19.13	10° 18' 087	9° 9' 31.61	9	36
25	9° 7' 43.12	19	9° 8' 19.41	10° 18' 059	9° 9' 31.52	8	35
26	9° 7' 42.72	19	9° 8' 19.68	10° 18' 032	9° 9' 31.44	8	34
27	9° 7' 42.32	20	9° 8' 19.96	10° 18' 004	9° 9' 31.36	9	33
28	9° 7' 41.92	19	9° 8' 20.23	10° 17' 977	9° 9' 31.27	8	32
29	9° 7' 41.52	19	9° 8' 20.51	10° 17' 949	9° 9' 31.19	8	31
30	9° 7' 41.12	20	9° 8' 20.78	10° 17' 922	9° 9' 31.11	9	30
	Cotang.	Coang.	Tangent.	Sine.			

[56 degrees.]

[33 degrees.]

	Sine.	Diff.	Tangent.	Coang.	Cotang.	D.	
30	9° 7' 41.12	19	9° 8' 20.78	10° 17' 922	9° 9' 31.11	9	30
31	9° 7' 40.72	19	9° 8' 21.06	10° 17' 894	9° 9' 31.02	8	29
32	9° 7' 40.32	20	9° 8' 21.33	10° 17' 867	9° 9' 30.94	9	28
33	9° 7' 40.32	19	9° 8' 21.61	10° 17' 839	9° 9' 30.86	8	27
34	9° 7' 40.32	20	9° 8' 21.88	10° 17' 812	9° 9' 30.77	9	26
35	9° 7' 40.32	19	9° 8' 22.15	10° 17' 785	9° 9' 30.69	8	25
36	9° 7' 40.32	20	9° 8' 22.43	10° 17' 757	9° 9' 30.60	9	24
37	9° 7' 40.32	19	9° 8' 22.70	10° 17' 730	9° 9' 30.52	8	23
38	9° 7' 40.32	20	9° 8' 22.98	10° 17' 702	9° 9' 30.44	9	22
39	9° 7' 40.32	19	9° 8' 23.25	10° 17' 675	9° 9' 30.35	8	21
40	9° 7' 40.32	20	9° 8' 23.52	10° 17' 648	9° 9' 30.27	9	20
41	9° 7' 40.32	19	9° 8' 23.80	10° 17' 620	9° 9' 30.18	8	19
42	9° 7' 40.32	20	9° 8' 24.07	10° 17' 593	9° 9' 30.10	9	18
43	9° 7' 40.32	19	9° 8' 24.35	10° 17' 565	9° 9' 30.02	8	17
44	9° 7' 40.32	20	9° 8' 24.62	10° 17' 538	9° 9' 29.93	9	16
45	9° 7' 40.32	19	9° 8' 24.89	10° 17' 511	9° 9' 29.85	8	15
46	9° 7' 40.32	20	9° 8' 25.17	10° 17' 483	9° 9' 29.77	9	14
47	9° 7' 40.32	19	9° 8' 25.44	10° 17' 456	9° 9' 29.68	8	13
48	9° 7' 40.32	20	9° 8' 25.71	10° 17' 429	9° 9' 29.59	9	12
49	9° 7' 40.32	19	9° 8' 25.98	10° 17' 401	9° 9' 29.51	8	11
50	9° 7' 40.32	20	9° 8' 26.26	10° 17' 374	9° 9' 29.42	9	10
51	9° 7' 40.32	19	9° 8' 26.53	10° 17' 347	9° 9' 29.34	8	9
52	9° 7' 40.32	20	9° 8' 26.81	10° 17' 319	9° 9' 29.25	9	8
53	9° 7' 40.32	19	9° 8' 27.08	10° 17' 292	9° 9' 29.17	8	7
54	9° 7' 40.32	20	9° 8' 27.35	10° 17' 265	9° 9' 29.08	9	6
55	9° 7' 40.32	19	9° 8' 27.62	10° 17' 238	9° 9' 29.00	8	5
56	9° 7' 40.32	20	9° 8' 27.90	10° 17' 210	9° 9' 28.91	9	4
57	9° 7' 40.32	19	9° 8' 28.17	10° 17' 183	9° 9' 28.83	8	3
58	9° 7' 40.32	20	9° 8' 28.44	10° 17' 156	9° 9' 28.74	9	2
59	9° 7' 40.32	19	9° 8' 28.71	10° 17' 129	9° 9' 28.66	8	1
60	9° 7' 40.32	20	9° 8' 28.99	10° 17' 101	9° 9' 28.57	9	0
	Cotang.	Coang.	Tangent.	Sine.			

[56 degrees.]

[34 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Co-sine.	D.	'
0	9°74755	19	9°82899	27	10°17101	9°91857	60	'
1	9°74775	19	9°82926	27	10°17074	9°91849	59	'
2	9°74794	18	9°82953	27	10°17047	9°91840	58	'
3	9°74812	19	9°82980	28	10°17020	9°91832	57	'
4	9°74831	19	9°83008	27	10°16992	9°91823	56	'
5	9°74850	18	9°83035	27	10°16965	9°91815	55	'
6	9°74868	18	9°83062	27	10°16938	9°91806	54	'
7	9°74887	19	9°83089	28	10°16911	9°91798	53	'
8	9°74906	18	9°83117	27	10°16883	9°91789	52	'
9	9°74924	18	9°83144	27	10°16856	9°91781	51	'
10	9°74943	18	9°83171	27	10°16829	9°91772	50	'
11	9°74961	19	9°83198	27	10°16802	9°91763	49	'
12	9°74980	19	9°83225	27	10°16775	9°91755	48	'
13	9°74999	18	9°83252	28	10°16748	9°91746	47	'
14	9°75017	18	9°83280	27	10°16720	9°91738	46	'
15	9°75036	18	9°83307	27	10°16693	9°91729	45	'
16	9°75054	19	9°83334	27	10°16666	9°91720	44	'
17	9°75073	18	9°83361	27	10°16639	9°91712	43	'
18	9°75091	19	9°83388	27	10°16612	9°91703	42	'
19	9°75110	18	9°83415	27	10°16585	9°91695	41	'
20	9°75128	18	9°83442	28	10°16558	9°91686	40	'
21	9°75147	19	9°83470	27	10°16530	9°91677	39	'
22	9°75165	18	9°83497	27	10°16503	9°91669	38	'
23	9°75184	18	9°83524	27	10°16476	9°91660	37	'
24	9°75202	19	9°83551	27	10°16449	9°91651	36	'
25	9°75221	18	9°83578	27	10°16422	9°91643	35	'
26	9°75239	18	9°83605	27	10°16395	9°91634	34	'
27	9°75258	19	9°83632	27	10°16368	9°91625	33	'
28	9°75276	18	9°83659	27	10°16341	9°91617	32	'
29	9°75294	18	9°83686	27	10°16314	9°91608	31	'
30	9°75313	19	9°83713	27	10°16287	9°91599	30	'
'	Co-sine.	Tangent.		Cotang.		Sine.		

[56 degrees.]

[34 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Co-sine.	D.	'
30	9°75333	18	9°83713	27	10°16287	9°91599	29	'
31	9°75351	19	9°83740	28	10°16260	9°91591	28	'
32	9°75369	18	9°83768	27	10°16232	9°91582	27	'
33	9°75388	19	9°83795	27	10°16205	9°91573	26	'
34	9°75406	18	9°83822	27	10°16178	9°91564	25	'
35	9°75425	18	9°83849	27	10°16151	9°91556	24	'
36	9°75443	18	9°83876	27	10°16124	9°91547	23	'
37	9°75461	19	9°83903	27	10°16097	9°91538	22	'
38	9°75479	19	9°83930	27	10°16070	9°91530	21	'
39	9°75497	18	9°83957	27	10°16043	9°91521	20	'
40	9°75515	18	9°83984	27	10°16016	9°91512	19	'
41	9°75533	19	9°84011	27	10°15989	9°91504	18	'
42	9°75551	18	9°84038	27	10°15962	9°91495	17	'
43	9°75569	18	9°84065	27	10°15935	9°91486	16	'
44	9°75587	18	9°84092	27	10°15908	9°91477	15	'
45	9°75605	19	9°84119	27	10°15881	9°91469	14	'
46	9°75623	18	9°84146	27	10°15854	9°91460	13	'
47	9°75641	18	9°84173	27	10°15827	9°91451	12	'
48	9°75659	19	9°84200	27	10°15800	9°91442	11	'
49	9°75677	18	9°84227	27	10°15773	9°91433	10	'
50	9°75695	18	9°84254	26	10°15746	9°91425	9	'
51	9°75713	18	9°84280	27	10°15720	9°91416	8	'
52	9°75731	19	9°84307	27	10°15693	9°91407	7	'
53	9°75749	18	9°84334	27	10°15666	9°91398	6	'
54	9°75767	18	9°84361	27	10°15639	9°91389	5	'
55	9°75785	19	9°84388	27	10°15612	9°91381	4	'
56	9°75803	18	9°84415	27	10°15585	9°91372	3	'
57	9°75821	18	9°84442	27	10°15558	9°91363	2	'
58	9°75839	19	9°84469	27	10°15531	9°91354	1	'
59	9°75857	18	9°84496	27	10°15504	9°91345	0	'
60	9°75875	19	9°84523	27	10°15477	9°91336	'	
'	Co-sine.	Tangent.		Cotang.		Sine.		

[56 degrees.]

[35 degrees.]

	Sine	D.M.	Tangent	Cotang.	Cosine	D.	
0	9 75589	18	9 84533	10 15477	9 91136	8	60
1	9 75577	18	9 84550	10 15450	9 91138	8	59
2	9 75595	18	9 84576	10 15444	9 91119	9	58
3	9 75593	18	9 84603	10 15397	9 91130	9	57
4	9 75593	18	9 84630	10 15370	9 91101	9	56
5	9 75594	18	9 84657	10 15343	9 91192	9	55
6	9 75597	18	9 84684	10 15316	9 91183	9	54
7	9 75595	18	9 84711	10 15289	9 91174	8	53
8	9 75603	18	9 84738	10 15262	9 91166	8	52
9	9 75621	18	9 84764	10 15236	9 91157	9	51
10	9 75639	18	9 84791	10 15209	9 91148	9	50
11	9 75657	18	9 84818	10 15182	9 91139	9	49
12	9 75675	18	9 84845	10 15155	9 91130	9	48
13	9 75693	18	9 84872	10 15128	9 91121	9	47
14	9 75711	18	9 84899	10 15101	9 91112	9	46
15	9 75729	17	9 84925	10 15075	9 91103	9	45
16	9 75746	18	9 84952	10 15048	9 91194	9	44
17	9 75764	18	9 84979	10 15021	9 91185	9	43
18	9 75782	18	9 85006	10 14994	9 91176	9	42
19	9 75800	18	9 85033	10 14967	9 91167	9	41
20	9 75818	18	9 85059	10 14941	9 91158	9	40
21	9 75836	18	9 85086	10 14914	9 91149	8	39
22	9 75853	17	9 85113	10 14887	9 91141	8	38
23	9 75871	18	9 85140	10 14860	9 91132	9	37
24	9 75889	18	9 85166	10 14834	9 91123	9	36
25	9 75907	17	9 85193	10 14807	9 91114	9	35
26	9 75924	18	9 85220	10 14780	9 91105	9	34
27	9 75942	18	9 85247	10 14753	9 91096	9	33
28	9 75960	18	9 85273	10 14727	9 91087	9	32
29	9 75978	17	9 85300	10 14700	9 91078	9	31
30	9 75995	17	9 85327	10 14673	9 91069	9	30
	Cosine		Cotang.	Tangent	Sine		

[64 degrees.]

[35 degrees.]

	Sine	D.M.	Tangent	Cotang.	Cosine	D.M.	
30	9 76195	18	9 85327	10 14673	9 91069	30	
31	9 76213	18	9 85354	10 14646	9 91060	9	29
32	9 76231	17	9 85380	10 14620	9 91051	9	28
33	9 76248	18	9 85407	10 14593	9 91042	9	27
34	9 76266	18	9 85434	10 14566	9 91033	9	26
35	9 76284	17	9 85460	10 14540	9 91023	9	25
36	9 76301	18	9 85487	10 14513	9 91014	9	24
37	9 76319	18	9 85514	10 14486	9 91005	9	23
38	9 76337	17	9 85540	10 14460	9 90996	9	22
39	9 76354	18	9 85567	10 14433	9 90987	9	21
40	9 76372	18	9 85594	10 14406	9 90978	9	20
41	9 76390	17	9 85620	10 14380	9 90969	9	19
42	9 76407	18	9 85647	10 14353	9 90960	9	18
43	9 76425	17	9 85674	10 14326	9 90951	9	17
44	9 76442	18	9 85700	10 14300	9 90942	9	16
45	9 76460	17	9 85727	10 14273	9 90933	9	15
46	9 76477	18	9 85754	10 14246	9 90924	9	14
47	9 76495	17	9 85780	10 14220	9 90915	9	13
48	9 76512	18	9 85807	10 14193	9 90906	9	12
49	9 76530	17	9 85834	10 14166	9 90896	9	11
50	9 76547	18	9 85860	10 14140	9 90887	9	10
51	9 76565	17	9 85887	10 14113	9 90878	9	9
52	9 76582	18	9 85913	10 14086	9 90869	9	8
53	9 76600	17	9 85940	10 14060	9 90860	9	7
54	9 76617	18	9 85967	10 14033	9 90851	9	6
55	9 76635	17	9 85993	10 14007	9 90842	9	5
56	9 76652	18	9 86020	10 13980	9 90832	9	4
57	9 76670	17	9 86046	10 13954	9 90823	9	3
58	9 76687	18	9 86073	10 13927	9 90814	9	2
59	9 76704	17	9 86100	10 13900	9 90805	9	1
60	9 76722	18	9 86126	10 13874	9 90796	9	0
	Cosine		Cotang.	Tangent	Sine		

[64 degrees.]

[36 degrees.]

°	'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Diff.	Cotang.	Diff.	'
0	0	9.76932	17	9.86126	27	10.13874	9.90796	60		
1	1	9.76939	18	9.86133	26	10.13847	9.90787	59		
2	2	9.76947	19	9.86141	25	10.13821	9.90777	58		
3	3	9.76954	18	9.86206	26	10.13794	9.90768	57		
4	4	9.76962	18	9.86213	27	10.13768	9.90759	56		
5	5	9.77009	17	9.86259	26	10.13741	9.90750	55		
6	6	9.77026	17	9.86285	27	10.13715	9.90741	54		
7	7	9.77043	18	9.86312	26	10.13688	9.90731	53		
8	8	9.77061	17	9.86338	27	10.13662	9.90722	52		
9	9	9.77078	17	9.86365	27	10.13635	9.90713	51		
10	10	9.77095	17	9.86392	26	10.13608	9.90704	50		
11	11	9.77112	18	9.86418	27	10.13582	9.90694	49		
12	12	9.77130	17	9.86445	26	10.13555	9.90685	48		
13	13	9.77147	17	9.86471	27	10.13529	9.90676	47		
14	14	9.77164	17	9.86498	26	10.13502	9.90667	46		
15	15	9.77181	18	9.86524	27	10.13476	9.90657	45		
16	16	9.77199	17	9.86551	26	10.13449	9.90648	44		
17	17	9.77216	17	9.86577	26	10.13423	9.90639	43		
18	18	9.77233	17	9.86603	27	10.13397	9.90630	42		
19	19	9.77250	18	9.86630	26	10.13370	9.90620	41		
20	20	9.77268	17	9.86656	27	10.13344	9.90611	40		
21	21	9.77285	17	9.86683	26	10.13317	9.90602	39		
22	22	9.77302	17	9.86709	27	10.13291	9.90592	38		
23	23	9.77319	17	9.86736	26	10.13264	9.90583	37		
24	24	9.77336	17	9.86762	27	10.13238	9.90574	36		
25	25	9.77353	17	9.86789	26	10.13211	9.90565	35		
26	26	9.77370	17	9.86815	27	10.13185	9.90555	34		
27	27	9.77387	18	9.86842	26	10.13158	9.90546	33		
28	28	9.77405	17	9.86868	26	10.13132	9.90537	32		
29	29	9.77422	17	9.86894	27	10.13106	9.90527	31		
30	30	9.77439		9.86921		10.13079	9.90518	30		
°	'	Cotang.	Diff.	Tangent.	Diff.	Cotang.	Diff.	Sine.		'

[53 degrees.]

°	'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Diff.	Cotang.	Diff.	'
30	30	9.77439	17	9.86947	26	10.13079	9.90518	30		
1	1	9.77456	17	9.86974	27	10.13052	9.90509	29		
2	2	9.77473	17	9.86974	26	10.13026	9.90499	28		
3	3	9.77490	17	9.87000	27	10.13000	9.90490	27		
4	4	9.77507	17	9.87027	26	10.12973	9.90480	26		
5	5	9.77524	17	9.87053	26	10.12947	9.90471	25		
6	6	9.77541	17	9.87079	27	10.12921	9.90462	24		
7	7	9.77558	17	9.87106	26	10.12894	9.90453	23		
8	8	9.77575	17	9.87132	26	10.12868	9.90443	22		
9	9	9.77592	17	9.87158	27	10.12842	9.90434	21		
10	10	9.77609	17	9.87185	26	10.12815	9.90424	20		
11	11	9.77626	17	9.87211	27	10.12789	9.90415	19		
12	12	9.77643	17	9.87238	26	10.12762	9.90405	18		
13	13	9.77660	17	9.87264	26	10.12736	9.90396	17		
14	14	9.77677	17	9.87290	27	10.12710	9.90386	16		
15	15	9.77694	17	9.87317	26	10.12683	9.90377	15		
16	16	9.77711	17	9.87343	27	10.12657	9.90368	14		
17	17	9.77728	16	9.87369	27	10.12631	9.90358	13		
18	18	9.77744	17	9.87396	26	10.12604	9.90349	12		
19	19	9.77761	17	9.87422	26	10.12578	9.90339	11		
20	20	9.77778	17	9.87448	27	10.12552	9.90330	10		
21	21	9.77795	17	9.87475	26	10.12525	9.90320	9		
22	22	9.77812	17	9.87501	26	10.12499	9.90311	8		
23	23	9.77829	17	9.87527	27	10.12473	9.90301	7		
24	24	9.77846	16	9.87554	26	10.12446	9.90292	6		
25	25	9.77863	17	9.87580	26	10.12420	9.90283	5		
26	26	9.77879	17	9.87606	27	10.12394	9.90273	4		
27	27	9.77896	17	9.87633	26	10.12367	9.90263	3		
28	28	9.77913	17	9.87659	26	10.12341	9.90254	2		
29	29	9.77930	16	9.87685	26	10.12315	9.90244	1		
30	30	9.77946		9.87711		10.12289	9.90235	0		
°	'	Cotang.	Diff.	Tangent.	Diff.	Cotang.	Diff.	Sine.		'

[53 degrees.]

[37 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Co-sine.	Diff.	
30	9.78445	16	9.88498	26	10.11502	9.99447	10	30
31	9.78461	17	9.88524	26	10.11476	9.99377	10	29
32	9.78478	16	9.88550	27	10.11450	9.99327	9	28
33	9.78494	16	9.88577	27	10.11423	9.99288	10	27
34	9.78510	17	9.88603	26	10.11397	9.99250	10	26
35	9.78527	16	9.88629	26	10.11371	9.99212	10	25
36	9.78543	17	9.88655	26	10.11345	9.99174	10	24
37	9.78560	16	9.88681	26	10.11319	9.99136	9	23
38	9.78576	16	9.88707	26	10.11293	9.99098	10	22
39	9.78592	17	9.88733	26	10.11267	9.99060	10	21
40	9.78609	16	9.88759	27	10.11241	9.99022	10	20
41	9.78625	17	9.88786	26	10.11214	9.98984	9	19
42	9.78642	16	9.88812	26	10.11188	9.98946	10	18
43	9.78658	16	9.88838	26	10.11162	9.98908	10	17
44	9.78674	17	9.88864	26	10.11136	9.98870	9	16
45	9.78691	16	9.88890	26	10.11110	9.98832	10	15
46	9.78707	16	9.88916	26	10.11084	9.98794	10	14
47	9.78723	16	9.88942	26	10.11058	9.98756	10	13
48	9.78739	17	9.88968	26	10.11032	9.98718	10	12
49	9.78756	16	9.88994	26	10.11006	9.98680	9	11
50	9.78772	16	9.89020	26	10.10980	9.98642	10	10
51	9.78788	17	9.89046	26	10.10954	9.98604	9	9
52	9.78805	16	9.89073	26	10.10927	9.98566	10	8
53	9.78821	16	9.89099	26	10.10901	9.98528	10	7
54	9.78837	16	9.89125	26	10.10875	9.98490	10	6
55	9.78853	16	9.89151	26	10.10849	9.98452	9	5
56	9.78869	17	9.89177	26	10.10823	9.98414	10	4
57	9.78886	16	9.89203	26	10.10797	9.98376	10	3
58	9.78902	16	9.89229	26	10.10771	9.98338	10	2
59	9.78918	16	9.89255	26	10.10745	9.98300	10	1
60	9.78934		9.89281		10.10719	9.98262		0
	Co-sine.		Cotang.		Tangent.	Sine.		

[52 degrees.]

[37 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Co-sine.	Diff.	
0	9.77046	17	9.87711	27	10.12289	9.90235	60	0
1	9.77063	17	9.87738	26	10.12263	9.90216	59	1
2	9.77080	17	9.87764	26	10.12236	9.90197	58	2
3	9.77097	16	9.87790	27	10.12210	9.90178	57	3
4	9.77113	16	9.87817	26	10.12183	9.90159	56	4
5	9.77130	17	9.87843	26	10.12157	9.90140	55	5
6	9.77147	16	9.87869	26	10.12131	9.90121	54	6
7	9.77164	16	9.87895	27	10.12105	9.90102	53	7
8	9.77180	17	9.87922	26	10.12078	9.90083	52	8
9	9.77197	16	9.87948	26	10.12052	9.90064	51	9
10	9.77213	17	9.87974	26	10.12026	9.90045	50	10
11	9.77230	17	9.88000	27	10.12000	9.90026	49	11
12	9.77247	16	9.88027	26	10.11973	9.90007	48	12
13	9.77263	17	9.88053	26	10.11947	9.90011	47	13
14	9.77280	17	9.88079	26	10.11921	9.90012	46	14
15	9.77297	16	9.88105	26	10.11895	9.90031	45	15
16	9.77313	17	9.88131	27	10.11869	9.90052	44	16
17	9.77330	16	9.88158	26	10.11843	9.90072	43	17
18	9.77346	17	9.88184	26	10.11816	9.90063	42	18
19	9.77363	17	9.88210	26	10.11790	9.90053	41	19
20	9.77380	16	9.88236	26	10.11764	9.90043	40	20
21	9.77396	17	9.88262	27	10.11738	9.90034	39	21
22	9.77413	16	9.88289	26	10.11711	9.90024	38	22
23	9.77429	17	9.88315	26	10.11685	9.90014	37	23
24	9.77446	16	9.88341	26	10.11659	9.90005	36	24
25	9.77463	17	9.88367	26	10.11633	9.99995	35	25
26	9.77479	16	9.88393	27	10.11607	9.99985	34	26
27	9.77495	17	9.88420	26	10.11580	9.99976	33	27
28	9.77512	16	9.88446	26	10.11554	9.99966	32	28
29	9.77528	17	9.88472	26	10.11528	9.99956	31	29
30	9.77545		9.88498		10.11502	9.99947	30	30
	Co-sine.		Cotang.		Tangent.	Sine.		

[52 degrees.]

[38 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Secant.	
0	9.78914	16	9.89218	26	10.10719	9.89653	60
1	9.78920	17	9.89237	26	10.10739	9.89643	59
2	9.78927	16	9.89253	26	10.10667	9.89633	58
3	9.78933	16	9.89269	26	10.10641	9.89624	57
4	9.78939	16	9.89285	26	10.10615	9.89614	56
5	9.78945	16	9.89301	26	10.10589	9.89604	55
6	9.78951	16	9.89317	26	10.10563	9.89594	54
7	9.78957	16	9.89333	26	10.10537	9.89584	53
8	9.78963	16	9.89349	26	10.10511	9.89574	52
9	9.78969	16	9.89365	26	10.10485	9.89564	51
10	9.78975	16	9.89381	26	10.10459	9.89554	50
11	9.78981	17	9.89397	26	10.10433	9.89544	49
12	9.78987	16	9.89413	26	10.10407	9.89534	48
13	9.78993	16	9.89429	26	10.10381	9.89524	47
14	9.78999	16	9.89445	26	10.10355	9.89514	46
15	9.79005	16	9.89461	26	10.10329	9.89504	45
16	9.79011	16	9.89477	26	10.10303	9.89495	44
17	9.79017	16	9.89493	26	10.10277	9.89485	43
18	9.79023	16	9.89509	26	10.10251	9.89475	42
19	9.79029	16	9.89525	26	10.10225	9.89465	41
20	9.79035	16	9.89541	26	10.10199	9.89455	40
21	9.79041	16	9.89557	26	10.10173	9.89445	39
22	9.79047	16	9.89573	26	10.10147	9.89435	38
23	9.79053	15	9.89589	26	10.10121	9.89425	37
24	9.79059	16	9.89605	26	10.10095	9.89415	36
25	9.79065	16	9.89621	26	10.10069	9.89405	35
26	9.79071	16	9.89637	26	10.10043	9.89395	34
27	9.79077	16	9.89653	26	10.10017	9.89385	33
28	9.79083	16	9.89669	26	10.09991	9.89375	32
29	9.79089	16	9.89685	26	10.09965	9.89364	31
30	9.79095	16	9.89701	26	10.09939	9.89354	30
	Secant.		Cotang.		Tangent.	Secant.	

[51 degrees.]

[38 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Secant.	
30	9.79145	16	9.90061	25	10.09919	9.89354	30
31	9.79151	16	9.90076	26	10.09904	9.89344	29
32	9.79157	16	9.90092	26	10.09888	9.89334	28
33	9.79163	16	9.90108	26	10.09862	9.89324	27
34	9.79169	15	9.90124	26	10.09846	9.89314	26
35	9.79175	16	9.90140	26	10.09830	9.89304	25
36	9.79181	16	9.90156	26	10.09814	9.89294	24
37	9.79187	16	9.90172	26	10.09798	9.89284	23
38	9.79193	16	9.90188	26	10.09782	9.89274	22
39	9.79199	15	9.90204	26	10.09766	9.89264	21
40	9.79205	16	9.90220	26	10.09750	9.89254	20
41	9.79211	16	9.90236	26	10.09734	9.89244	19
42	9.79217	16	9.90252	26	10.09718	9.89234	18
43	9.79223	15	9.90268	26	10.09702	9.89224	17
44	9.79229	16	9.90284	26	10.09686	9.89214	16
45	9.79235	16	9.90300	26	10.09670	9.89204	15
46	9.79241	16	9.90316	26	10.09654	9.89194	14
47	9.79247	15	9.90332	26	10.09638	9.89184	13
48	9.79253	16	9.90348	26	10.09622	9.89174	12
49	9.79259	16	9.90364	26	10.09606	9.89164	11
50	9.79265	16	9.90380	25	10.09590	9.89154	10
51	9.79271	15	9.90396	26	10.09574	9.89144	9
52	9.79277	16	9.90412	26	10.09558	9.89134	8
53	9.79283	15	9.90428	26	10.09542	9.89124	7
54	9.79289	16	9.90444	26	10.09526	9.89114	6
55	9.79295	16	9.90460	26	10.09510	9.89104	5
56	9.79301	15	9.90476	26	10.09494	9.89094	4
57	9.79307	16	9.90492	26	10.09478	9.89084	3
58	9.79313	16	9.90508	26	10.09462	9.89074	2
59	9.79319	15	9.90524	26	10.09446	9.89064	1
60	9.79325	16	9.90540	26	10.09430	9.89054	0
	Secant.		Cotang.		Tangent.	Secant.	

[51 degrees.]

[39 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	'
0	9.79837	16	9.90837	26	10.09163	9.89050	10	60
1	9.79903	16	9.90853	26	10.09147	9.89040	10	59
2	9.79918	16	9.90869	25	10.09131	9.89030	10	58
3	9.79934	16	9.90914	26	10.09086	9.89020	10	57
4	9.79950	16	9.90940	26	10.09060	9.89009	10	56
5	9.79965	15	9.90966	26	10.09034	9.88999	10	55
6	9.79981	15	9.90992	26	10.09008	9.88989	11	54
7	9.79996	15	9.91018	25	10.08982	9.88978	10	53
8	9.80012	15	9.91043	26	10.08957	9.88968	10	52
9	9.80027	15	9.91069	26	10.08931	9.88958	10	51
10	9.80043	15	9.91095	26	10.08905	9.88948	11	50
11	9.80058	16	9.91121	26	10.08879	9.88937	10	49
12	9.80074	15	9.91147	25	10.08853	9.88927	10	48
13	9.80089	16	9.91172	26	10.08828	9.88917	11	47
14	9.80105	15	9.91198	26	10.08802	9.88906	10	46
15	9.80120	16	9.91224	26	10.08776	9.88896	10	45
16	9.80136	15	9.91250	26	10.08750	9.88886	11	44
17	9.80151	15	9.91276	25	10.08724	9.88875	10	43
18	9.80166	16	9.91301	26	10.08699	9.88865	10	42
19	9.80182	15	9.91327	26	10.08673	9.88855	11	41
20	9.80197	16	9.91353	26	10.08647	9.88844	10	40
21	9.80213	15	9.91379	26	10.08621	9.88834	10	39
22	9.80228	16	9.91404	26	10.08596	9.88824	11	38
23	9.80244	15	9.91430	26	10.08570	9.88813	10	37
24	9.80259	15	9.91456	26	10.08544	9.88803	10	36
25	9.80274	16	9.91482	25	10.08518	9.88793	11	35
26	9.80290	15	9.91507	26	10.08493	9.88782	10	34
27	9.80305	15	9.91533	26	10.08467	9.88772	11	33
28	9.80320	16	9.91559	26	10.08441	9.88761	10	32
29	9.80336	15	9.91585	25	10.08415	9.88751	11	31
30	9.80351	15	9.91610	26	10.08390	9.88741	10	30
'	Cosine.		Cotang.		Tangent.	Sine.		'

[50 degrees.]

[39 degrees.]

'	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	'
30	9.80351	15	9.91610	26	10.08390	9.88741	11	30
31	9.80366	16	9.91636	26	10.08364	9.88730	10	29
32	9.80382	15	9.91662	26	10.08338	9.88720	10	28
33	9.80397	15	9.91688	25	10.08312	9.88709	11	27
34	9.80413	16	9.91713	26	10.08287	9.88699	10	26
35	9.80428	15	9.91739	26	10.08261	9.88688	11	25
36	9.80443	15	9.91765	26	10.08235	9.88678	10	24
37	9.80458	15	9.91791	25	10.08209	9.88668	11	23
38	9.80473	16	9.91816	26	10.08184	9.88657	10	22
39	9.80489	15	9.91842	26	10.08158	9.88647	11	21
40	9.80504	15	9.91868	25	10.08132	9.88636	10	20
41	9.80519	15	9.91893	26	10.08107	9.88626	11	19
42	9.80534	16	9.91919	26	10.08081	9.88615	10	18
43	9.80550	15	9.91945	26	10.08055	9.88605	11	17
44	9.80565	15	9.91971	25	10.08029	9.88594	10	16
45	9.80580	15	9.91996	26	10.08004	9.88584	11	15
46	9.80595	15	9.92022	26	10.07978	9.88573	10	14
47	9.80610	15	9.92048	25	10.07952	9.88563	11	13
48	9.80625	16	9.92073	26	10.07927	9.88552	10	12
49	9.80641	15	9.92099	26	10.07901	9.88542	11	11
50	9.80656	15	9.92125	25	10.07875	9.88531	10	10
51	9.80671	16	9.92150	26	10.07850	9.88521	11	9
52	9.80686	15	9.92176	26	10.07824	9.88510	10	8
53	9.80701	15	9.92202	25	10.07798	9.88499	11	7
54	9.80716	16	9.92227	26	10.07773	9.88489	10	6
55	9.80731	15	9.92253	26	10.07747	9.88478	11	5
56	9.80746	16	9.92279	25	10.07721	9.88468	10	4
57	9.80762	15	9.92304	26	10.07696	9.88457	11	3
58	9.80777	15	9.92330	26	10.07670	9.88447	10	2
59	9.80792	15	9.92356	25	10.07644	9.88436	11	1
60	9.80807	15	9.92381	25	10.07619	9.88425	10	0
'	Cosine.		Cotang.		Tangent.	Sine.		'

[50 degrees.]



[40 degrees.]

	Sine.	Dif.	Tangent.	Cotang.	Secant.	Dif.
0	9° 8' 08.07	15	9° 9' 38.1	10° 0' 76.19	9° 8' 42.5	60
1	9° 8' 08.32	15	9° 9' 40.7	10° 0' 75.93	9° 8' 41.5	59
2	9° 8' 08.57	15	9° 9' 43.3	10° 0' 75.67	9° 8' 40.4	58
3	9° 8' 08.82	15	9° 9' 45.8	10° 0' 75.42	9° 8' 39.4	57
4	9° 8' 08.87	15	9° 9' 48.4	10° 0' 75.16	9° 8' 38.3	56
5	9° 8' 08.82	15	9° 9' 51.0	10° 0' 74.90	9° 8' 37.2	55
6	9° 8' 08.07	15	9° 9' 53.5	10° 0' 74.65	9° 8' 36.2	54
7	9° 8' 09.12	15	9° 9' 56.1	10° 0' 74.39	9° 8' 35.1	53
8	9° 8' 09.27	15	9° 9' 58.7	10° 0' 74.13	9° 8' 34.0	52
9	9° 8' 09.42	15	9° 9' 56.2	10° 0' 73.88	9° 8' 33.0	51
10	9° 8' 09.57	15	9° 9' 56.3	10° 0' 73.62	9° 8' 31.9	50
11	9° 8' 09.72	15	9° 9' 56.3	10° 0' 73.37	9° 8' 30.8	49
12	9° 8' 09.87	15	9° 9' 56.9	10° 0' 73.11	9° 8' 29.8	48
13	9° 8' 10.02	15	9° 9' 57.5	10° 0' 72.85	9° 8' 28.7	47
14	9° 8' 10.17	15	9° 9' 57.40	10° 0' 72.60	9° 8' 27.6	46
15	9° 8' 10.32	15	9° 9' 57.66	10° 0' 72.34	9° 8' 26.6	45
16	9° 8' 10.47	15	9° 9' 57.92	10° 0' 72.08	9° 8' 25.5	44
17	9° 8' 10.61	15	9° 9' 58.17	10° 0' 71.83	9° 8' 24.4	43
18	9° 8' 10.76	15	9° 9' 58.43	10° 0' 71.57	9° 8' 23.4	42
19	9° 8' 10.91	15	9° 9' 58.68	10° 0' 71.32	9° 8' 22.3	41
20	9° 8' 11.06	15	9° 9' 58.94	10° 0' 71.06	9° 8' 21.2	40
21	9° 8' 11.21	15	9° 9' 59.20	10° 0' 70.80	9° 8' 20.1	39
22	9° 8' 11.36	15	9° 9' 59.45	10° 0' 70.55	9° 8' 19.1	38
23	9° 8' 11.51	15	9° 9' 59.71	10° 0' 70.29	9° 8' 18.0	37
24	9° 8' 11.66	15	9° 9' 59.96	10° 0' 70.04	9° 8' 16.9	36
25	9° 8' 11.81	15	9° 9' 59.26	10° 0' 69.78	9° 8' 15.8	35
26	9° 8' 11.95	15	9° 9' 59.48	10° 0' 69.52	9° 8' 14.8	34
27	9° 8' 12.10	15	9° 9' 59.73	10° 0' 69.27	9° 8' 13.7	33
28	9° 8' 12.25	15	9° 9' 59.99	10° 0' 69.01	9° 8' 12.6	32
29	9° 8' 12.40	15	9° 9' 59.24	10° 0' 68.76	9° 8' 11.5	31
30	9° 8' 12.54	15	9° 9' 59.50	10° 0' 68.50	9° 8' 10.5	30
	Secant.	Tangent.	Cotang.	Sine.		

[49 degrees.]

	Sine.	Dif.	Tangent.	Cotang.	Secant.	Dif.
30	9° 8' 12.54	15	9° 9' 59.50	10° 0' 68.50	9° 8' 10.5	30
31	9° 8' 12.69	15	9° 9' 59.75	10° 0' 68.25	9° 8' 09.4	29
32	9° 8' 12.84	15	9° 9' 59.99	10° 0' 68.00	9° 8' 08.3	28
33	9° 8' 12.99	15	9° 9' 59.27	10° 0' 67.75	9° 8' 07.2	27
34	9° 8' 13.14	15	9° 9' 59.52	10° 0' 67.50	9° 8' 06.1	26
35	9° 8' 13.28	15	9° 9' 59.78	10° 0' 67.25	9° 8' 05.1	25
36	9° 8' 13.43	15	9° 9' 59.30	10° 0' 67.00	9° 8' 04.0	24
37	9° 8' 13.58	15	9° 9' 59.55	10° 0' 66.75	9° 8' 02.9	23
38	9° 8' 13.72	15	9° 9' 59.80	10° 0' 66.50	9° 8' 01.8	22
39	9° 8' 13.87	15	9° 9' 59.38	10° 0' 66.25	9° 8' 00.7	21
40	9° 8' 14.02	15	9° 9' 59.63	10° 0' 66.00	9° 7' 59.6	20
41	9° 8' 14.17	15	9° 9' 59.87	10° 0' 65.75	9° 7' 58.5	19
42	9° 8' 14.31	15	9° 9' 59.47	10° 0' 65.50	9° 7' 57.5	18
43	9° 8' 14.46	15	9° 9' 59.72	10° 0' 65.25	9° 7' 56.4	17
44	9° 8' 14.61	15	9° 9' 59.97	10° 0' 65.00	9° 7' 55.3	16
45	9° 8' 14.75	15	9° 9' 59.33	10° 0' 64.75	9° 7' 54.2	15
46	9° 8' 14.90	15	9° 9' 59.58	10° 0' 64.50	9° 7' 53.1	14
47	9° 8' 15.05	15	9° 9' 59.84	10° 0' 64.25	9° 7' 52.0	13
48	9° 8' 15.19	15	9° 9' 59.10	10° 0' 64.00	9° 7' 50.9	12
49	9° 8' 15.34	15	9° 9' 59.36	10° 0' 63.75	9° 7' 49.8	11
50	9° 8' 15.49	15	9° 9' 59.61	10° 0' 63.50	9° 7' 48.7	10
51	9° 8' 15.63	15	9° 9' 59.87	10° 0' 63.25	9° 7' 47.7	9
52	9° 8' 15.78	15	9° 9' 59.12	10° 0' 63.00	9° 7' 46.6	8
53	9° 8' 15.92	15	9° 9' 59.38	10° 0' 62.75	9° 7' 45.5	7
54	9° 8' 16.07	15	9° 9' 59.63	10° 0' 62.50	9° 7' 44.4	6
55	9° 8' 16.22	15	9° 9' 59.89	10° 0' 62.25	9° 7' 43.3	5
56	9° 8' 16.36	15	9° 9' 59.14	10° 0' 62.00	9° 7' 42.2	4
57	9° 8' 16.51	15	9° 9' 59.40	10° 0' 61.75	9° 7' 41.1	3
58	9° 8' 16.65	15	9° 9' 59.65	10° 0' 61.50	9° 7' 40.0	2
59	9° 8' 16.80	15	9° 9' 59.91	10° 0' 61.25	9° 7' 38.9	1
60	9° 8' 16.94	15	9° 9' 59.16	10° 0' 61.00	9° 7' 37.8	0
	Secant.	Tangent.	Cotang.	Sine.		

[49 degrees.]

[40 degrees.]

**[4] degrees.]**

	Sine.	Dist.	Tangent.	Cotang.	Dist.	Cotang.	Sine.
0	9° 3' 1694	15	9° 3' 9116	26	10° 0' 6084	9° 8' 7778	60
1	9° 3' 1709	14	9° 3' 9242	25	10° 0' 6058	9° 8' 7767	59
2	9° 3' 1723	13	9° 3' 9367	24	10° 0' 6033	9° 8' 7756	58
3	9° 3' 1738	12	9° 3' 9493	23	10° 0' 6007	9° 8' 7745	57
4	9° 3' 1752	11	9° 3' 9618	22	10° 0' 5982	9° 8' 7734	56
5	9° 3' 1767	10	9° 3' 9644	21	10° 0' 5956	9° 8' 7723	55
6	9° 3' 1781	9	9° 3' 9669	20	10° 0' 5931	9° 8' 7712	54
7	9° 3' 1796	8	9° 3' 9695	19	10° 0' 5905	9° 8' 7701	53
8	9° 3' 1810	7	9° 3' 9720	18	10° 0' 5880	9° 8' 7690	52
9	9° 3' 1825	6	9° 3' 9746	17	10° 0' 5854	9° 8' 7679	51
10	9° 3' 1839	5	9° 3' 9771	16	10° 0' 5829	9° 8' 7668	50
11	9° 3' 1854	4	9° 3' 9797	15	10° 0' 5803	9° 8' 7657	49
12	9° 3' 1868	3	9° 3' 9822	14	10° 0' 5778	9° 8' 7646	48
13	9° 3' 1882	2	9° 3' 9848	13	10° 0' 5752	9° 8' 7635	47
14	9° 3' 1897	1	9° 3' 9873	12	10° 0' 5727	9° 8' 7624	46
15	9° 3' 1911	0	9° 3' 9899	11	10° 0' 5701	9° 8' 7613	45
16	9° 3' 1926	0	9° 3' 9924	10	10° 0' 5676	9° 8' 7602	44
17	9° 3' 1940	0	9° 3' 9950	9	10° 0' 5650	9° 8' 7590	43
18	9° 3' 1955	0	9° 3' 9975	8	10° 0' 5625	9° 8' 7579	42
19	9° 3' 1969	0	9° 3' 9999	7	10° 0' 5599	9° 8' 7568	41
20	9° 3' 1983	0	9° 3' 9946	6	10° 0' 5574	9° 8' 7557	40
21	9° 3' 1998	0	9° 3' 9445	5	10° 0' 5548	9° 8' 7546	39
22	9° 3' 2012	0	9° 3' 9447	4	10° 0' 5523	9° 8' 7535	38
23	9° 3' 2026	0	9° 3' 9450	3	10° 0' 5497	9° 8' 7524	37
24	9° 3' 2041	0	9° 3' 9458	2	10° 0' 5472	9° 8' 7513	36
25	9° 3' 2055	0	9° 3' 9454	1	10° 0' 5446	9° 8' 7501	35
26	9° 3' 2069	0	9° 3' 9457	0	10° 0' 5421	9° 8' 7490	34
27	9° 3' 2084	0	9° 3' 9460	0	10° 0' 5396	9° 8' 7479	33
28	9° 3' 2098	0	9° 3' 9463	0	10° 0' 5370	9° 8' 7468	32
29	9° 3' 2112	0	9° 3' 9465	0	10° 0' 5345	9° 8' 7457	31
30	9° 3' 2126	0	9° 3' 9468	0	10° 0' 5319	9° 8' 7446	30

**[41 degrees.]**

°	'	Sine.	Dif.	Tangent.	Cotang.	Secans.	Dif.	°
30		9.8216	15	9.94681	10.05319	9.87446	12	30
31		9.8211	14	9.94706	10.05294	9.87434	29	31
32		9.8215	14	9.94732	10.05268	9.87423	28	32
33		9.8219	14	9.94757	10.05243	9.87413	27	33
34		9.8224	14	9.94783	10.05217	9.87402	26	34
35		9.8229	14	9.94808	10.05192	9.87390	25	35
36		9.8233	14	9.94834	10.05166	9.87378	24	36
37		9.8236	14	9.94859	10.05141	9.87367	23	37
38		9.8240	14	9.94884	10.05116	9.87356	22	38
39		9.8245	15	9.94910	10.05090	9.87345	21	39
40		9.8249	14	9.94935	10.05065	9.87334	20	40
41		9.8253	14	9.94961	10.05039	9.87322	19	41
42		9.8257	14	9.94986	10.05014	9.87311	18	42
43		9.8261	14	9.95012	10.04988	9.87299	17	43
44		9.8266	14	9.95037	10.04963	9.87288	16	44
45		9.8270	14	9.95062	10.04938	9.87277	15	45
46		9.8274	14	9.95088	10.04913	9.87266	14	46
47		9.8278	14	9.95113	10.04887	9.87255	13	47
48		9.8282	14	9.95139	10.04861	9.87243	12	48
49		9.8286	14	9.95164	10.04836	9.87232	11	49
50		9.8291	14	9.95190	10.04810	9.87221	10	50
51		9.8294	14	9.95215	10.04785	9.87209	9	51
52		9.8298	14	9.95240	10.04760	9.87198	8	52
53		9.8303	14	9.95266	10.04734	9.87187	7	53
54		9.8307	14	9.95291	10.04709	9.87175	6	54
55		9.8311	14	9.95317	10.04683	9.87164	5	55
56		9.8315	14	9.95342	10.04658	9.87153	4	56
57		9.8319	14	9.95368	10.04632	9.87141	3	57
58		9.8323	14	9.95393	10.04607	9.87130	2	58
59		9.8327	14	9.95418	10.04582	9.87119	1	59
60		9.8331	14	9.95444	10.04556	9.87107	0	60
°	'	Co-sine.	Cotang.	Tangent.	Secans.	Dif.	'	°

[48 degrees.]

**[48 degrees.]**

[42 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Co-sine.	Diff.	
0	9° 32' 55.1	14	9° 54' 44	25	10° 04' 556	9° 8' 107	11	60
1	9° 32' 55.5	14	9° 54' 59	26	10° 04' 531	9° 8' 706	11	59
2	9° 32' 55.9	14	9° 55' 13	26	10° 04' 505	9° 8' 708	11	58
3	9° 32' 56.3	14	9° 55' 27	26	10° 04' 480	9° 8' 703	12	57
4	9° 32' 56.7	14	9° 55' 41	26	10° 04' 455	9° 8' 702	12	56
5	9° 32' 57.1	14	9° 55' 55	26	10° 04' 429	9° 8' 709	11	55
6	9° 32' 57.5	14	9° 56' 09	26	10° 04' 404	9° 8' 703	11	54
7	9° 32' 57.9	14	9° 56' 23	26	10° 04' 378	9° 8' 702	11	53
8	9° 32' 58.3	14	9° 56' 37	26	10° 04' 353	9° 8' 701	12	52
9	9° 32' 58.7	14	9° 56' 51	26	10° 04' 328	9° 8' 700	11	51
10	9° 32' 59.1	14	9° 57' 05	26	10° 04' 302	9° 8' 699	11	50
11	9° 32' 59.5	14	9° 57' 19	26	10° 04' 277	9° 8' 698	11	49
12	9° 32' 59.9	14	9° 57' 33	26	10° 04' 252	9° 8' 697	12	48
13	9° 32' 60.3	14	9° 57' 47	26	10° 04' 226	9° 8' 695	11	47
14	9° 32' 60.7	14	9° 57' 61	26	10° 04' 201	9° 8' 694	12	46
15	9° 32' 61.1	14	9° 57' 75	26	10° 04' 175	9° 8' 693	11	45
16	9° 32' 61.5	14	9° 57' 89	26	10° 04' 150	9° 8' 692	12	44
17	9° 32' 61.9	14	9° 57' 103	26	10° 04' 125	9° 8' 691	11	43
18	9° 32' 62.3	14	9° 57' 117	26	10° 04' 099	9° 8' 690	12	42
19	9° 32' 62.7	14	9° 57' 131	26	10° 04' 074	9° 8' 689	11	41
20	9° 32' 63.1	14	9° 57' 145	26	10° 04' 048	9° 8' 687	11	40
21	9° 32' 63.5	14	9° 57' 159	26	10° 04' 023	9° 8' 686	12	39
22	9° 32' 63.9	14	9° 57' 173	26	10° 03' 998	9° 8' 685	11	38
23	9° 32' 64.3	14	9° 57' 187	26	10° 03' 972	9° 8' 684	12	37
24	9° 32' 64.7	14	9° 57' 201	26	10° 03' 947	9° 8' 683	11	36
25	9° 32' 65.1	14	9° 57' 215	26	10° 03' 922	9° 8' 682	12	35
26	9° 32' 65.5	14	9° 57' 229	26	10° 03' 896	9° 8' 680	11	34
27	9° 32' 65.9	14	9° 57' 243	26	10° 03' 871	9° 8' 678	12	33
28	9° 32' 66.3	14	9° 57' 257	26	10° 03' 845	9° 8' 676	11	32
29	9° 32' 66.7	14	9° 57' 271	26	10° 03' 820	9° 8' 675	12	31
30	9° 32' 67.1	14	9° 57' 285	26	10° 03' 795	9° 8' 673	11	30

[47 degrees.]

[42 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Co-sine.	Diff.	
30	9° 32' 56.8	14	9° 56' 205	26	10° 03' 795	9° 8' 761	11	30
31	9° 32' 57.2	14	9° 56' 219	26	10° 03' 769	9° 8' 759	11	29
32	9° 32' 57.6	14	9° 56' 233	26	10° 03' 744	9° 8' 740	12	28
33	9° 32' 58.0	14	9° 56' 247	26	10° 03' 719	9° 8' 738	11	27
34	9° 32' 58.4	14	9° 56' 261	26	10° 03' 693	9° 8' 717	12	26
35	9° 32' 58.8	14	9° 56' 275	26	10° 03' 668	9° 8' 705	11	25
36	9° 32' 59.2	14	9° 56' 289	26	10° 03' 643	9° 8' 694	12	24
37	9° 32' 59.6	14	9° 56' 303	26	10° 03' 617	9° 8' 682	11	23
38	9° 32' 60.0	14	9° 56' 317	26	10° 03' 592	9° 8' 670	12	22
39	9° 32' 60.4	14	9° 56' 331	26	10° 03' 567	9° 8' 659	11	21
40	9° 32' 60.8	14	9° 56' 345	26	10° 03' 541	9° 8' 647	12	20
41	9° 32' 61.2	14	9° 56' 359	26	10° 03' 516	9° 8' 635	11	19
42	9° 32' 61.6	14	9° 56' 373	26	10° 03' 490	9° 8' 624	12	18
43	9° 32' 62.0	14	9° 56' 387	26	10° 03' 465	9° 8' 612	11	17
44	9° 32' 62.4	14	9° 56' 401	26	10° 03' 440	9° 8' 600	12	16
45	9° 32' 62.8	14	9° 56' 415	26	10° 03' 414	9° 8' 589	11	15
46	9° 32' 63.2	14	9° 56' 429	26	10° 03' 389	9° 8' 577	12	14
47	9° 32' 63.6	14	9° 56' 443	26	10° 03' 364	9° 8' 565	11	13
48	9° 32' 64.0	14	9° 56' 457	26	10° 03' 338	9° 8' 554	12	12
49	9° 32' 64.4	14	9° 56' 471	26	10° 03' 313	9° 8' 542	11	11
50	9° 32' 64.8	14	9° 56' 485	26	10° 03' 288	9° 8' 530	12	10
51	9° 32' 65.2	14	9° 56' 499	26	10° 03' 262	9° 8' 518	11	9
52	9° 32' 65.6	14	9° 56' 513	26	10° 03' 237	9° 8' 507	12	8
53	9° 32' 66.0	14	9° 56' 527	26	10° 03' 212	9° 8' 495	11	7
54	9° 32' 66.4	14	9° 56' 541	26	10° 03' 186	9° 8' 483	12	6
55	9° 32' 66.8	14	9° 56' 555	26	10° 03' 161	9° 8' 472	11	5
56	9° 32' 67.2	14	9° 56' 569	26	10° 03' 136	9° 8' 460	12	4
57	9° 32' 67.6	14	9° 56' 583	26	10° 03' 110	9° 8' 448	11	3
58	9° 32' 68.0	14	9° 56' 597	26	10° 03' 085	9° 8' 436	12	2
59	9° 32' 68.4	14	9° 57' 011	26	10° 03' 060	9° 8' 425	11	1
60	9° 32' 68.8	14	9° 57' 025	26	10° 03' 034	9° 8' 413	12	0

[47 degrees.]

[43 degrees.]

	Sine.	Diff.	Tangent.	Cotang.	Cosine.	Diff.	
0	9°33'38"	14	9°96'56"	10°03'04"	9°86'13"	60	
1	9°33'39"	14	9°96'57"	10°03'03"	9°86'10"	59	
2	9°33'40"	14	9°97'01"	10°02'58"	9°86'39"	58	
3	9°33'41"	14	9°97'04"	10°02'55"	9°86'37"	57	
4	9°33'42"	14	9°97'06"	10°02'53"	9°86'36"	56	
5	9°33'44"	13	9°97'09"	10°02'50"	9°86'35"	55	
6	9°33'45"	13	9°97'11"	10°02'48"	9°86'34"	54	
7	9°33'47"	13	9°97'14"	10°02'45"	9°86'33"	53	
8	9°33'48"	14	9°97'16"	10°02'43"	9°86'31"	52	
9	9°33'50"	13	9°97'19"	10°02'40"	9°86'30"	51	
10	9°33'51"	13	9°97'21"	10°02'38"	9°86'29"	50	
11	9°33'52"	13	9°97'24"	10°02'35"	9°86'28"	49	
12	9°33'54"	14	9°97'26"	10°02'33"	9°86'27"	48	
13	9°33'54"	13	9°97'29"	10°02'30"	9°86'25"	47	
14	9°33'57"	14	9°97'30"	10°02'28"	9°86'24"	46	
15	9°33'58"	14	9°97'34"	10°02'25"	9°86'23"	45	
16	9°33'59"	14	9°97'37"	10°02'22"	9°86'22"	44	
17	9°33'58"	13	9°97'39"	10°02'20"	9°86'21"	43	
18	9°33'59"	13	9°97'41"	10°02'17"	9°86'20"	42	
19	9°33'59"	14	9°97'44"	10°02'15"	9°86'18"	41	
20	9°33'58"	13	9°97'47"	10°02'12"	9°86'17"	40	
21	9°33'56"	13	9°97'49"	10°02'10"	9°86'16"	39	
22	9°33'57"	14	9°97'53"	10°02'07"	9°86'15"	38	
23	9°33'58"	13	9°97'54"	10°02'05"	9°86'14"	37	
24	9°33'59"	13	9°97'57"	10°02'02"	9°86'12"	36	
25	9°33'57"	13	9°97'58"	10°02'00"	9°86'11"	35	
26	9°33'58"	13	9°97'62"	10°01'57"	9°86'10"	34	
27	9°33'57"	13	9°97'64"	10°01'55"	9°86'09"	33	
28	9°33'55"	13	9°97'67"	10°01'52"	9°86'08"	32	
29	9°33'56"	13	9°97'69"	10°01'50"	9°86'08"	31	
30	9°33'58"	13	9°97'75"	10°01'47"	9°86'06"	30	
			Cotang.	Tangent.	Sine.		

[46 degrees.]

[43 degrees.]

	Sine.	Diff.	Tangent.	Cotang.	Cosine.	Diff.	
30	9°33'78"	14	9°97'75"	10°02'25"	9°86'56"	30	
31	9°33'79"	13	9°97'76"	10°02'24"	9°86'54"	29	
32	9°33'80"	13	9°97'77"	10°02'22"	9°86'53"	28	
33	9°33'82"	13	9°97'80"	10°02'19"	9°86'50"	27	
34	9°33'83"	14	9°97'82"	10°02'17"	9°86'48"	26	
35	9°33'84"	13	9°97'85"	10°02'14"	9°86'46"	25	
36	9°33'86"	13	9°97'87"	10°02'12"	9°86'44"	24	
37	9°33'87"	13	9°97'90"	10°02'09"	9°86'42"	23	
38	9°33'88"	14	9°97'92"	10°02'07"	9°86'40"	22	
39	9°33'90"	13	9°97'95"	10°02'04"	9°86'38"	21	
40	9°33'91"	13	9°97'98"	10°02'02"	9°86'36"	20	
41	9°33'92"	13	9°98'00"	10°01'59"	9°86'34"	19	
42	9°33'94"	14	9°98'02"	10°01'56"	9°86'32"	18	
43	9°33'95"	13	9°98'04"	10°01'54"	9°86'30"	17	
44	9°33'96"	13	9°98'07"	10°01'51"	9°86'28"	16	
45	9°33'98"	13	9°98'10"	10°01'48"	9°86'26"	15	
46	9°33'99"	13	9°98'13"	10°01'45"	9°86'24"	14	
47	9°34'00"	14	9°98'15"	10°01'43"	9°86'22"	13	
48	9°34'02"	13	9°98'18"	10°01'40"	9°86'20"	12	
49	9°34'03"	13	9°98'20"	10°01'37"	9°86'18"	11	
50	9°34'04"	13	9°98'23"	10°01'35"	9°86'16"	10	
51	9°34'05"	13	9°98'26"	10°01'32"	9°86'14"	9	
52	9°34'07"	13	9°98'28"	10°01'29"	9°86'12"	8	
53	9°34'08"	13	9°98'30"	10°01'27"	9°86'10"	7	
54	9°34'08"	14	9°98'32"	10°01'24"	9°86'08"	6	
55	9°34'11"	13	9°98'35"	10°01'21"	9°86'06"	5	
56	9°34'15"	13	9°98'38"	10°01'18"	9°86'04"	4	
57	9°34'18"	13	9°98'40"	10°01'16"	9°86'02"	3	
58	9°34'19"	13	9°98'43"	10°01'13"	9°86'00"	2	
59	9°34'20"	13	9°98'46"	10°01'10"	9°85'58"	1	
60	9°34'21"	13	9°98'48"	10°01'08"	9°85'56"	0	
			Cotang.	Tangent.	Sine.		

[46 degrees.]

[44 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	
0	9 84177	13	9 98424	25	10 01516	9 85693	12	60
1	9 84190	13	9 98509	25	10 01491	9 85681	12	59
2	9 84203	13	9 98553	25	10 01466	9 85669	12	58
3	9 84216	13	9 98560	25	10 01440	9 85657	12	57
4	9 84229	13	9 98585	25	10 01415	9 85645	12	56
5	9 84242	13	9 98610	25	10 01390	9 85632	12	55
6	9 84255	13	9 98635	25	10 01365	9 85620	12	54
7	9 84269	13	9 98661	25	10 01339	9 85608	12	53
8	9 84282	13	9 98686	25	10 01314	9 85596	12	52
9	9 84295	13	9 98711	25	10 01289	9 85583	12	51
10	9 84308	13	9 98737	25	10 01263	9 85571	12	50
11	9 84321	13	9 98762	25	10 01238	9 85559	12	49
12	9 84334	13	9 98787	25	10 01213	9 85547	12	48
13	9 84347	13	9 98812	25	10 01188	9 85534	12	47
14	9 84360	13	9 98838	25	10 01162	9 85522	12	46
15	9 84373	13	9 98863	25	10 01137	9 85510	12	45
16	9 84385	13	9 98888	25	10 01112	9 85497	12	44
17	9 84398	13	9 98913	25	10 01087	9 85485	12	43
18	9 84411	13	9 98939	25	10 01061	9 85473	12	42
19	9 84424	13	9 98964	25	10 01036	9 85460	12	41
20	9 84437	13	9 98989	25	10 01011	9 85448	12	40
21	9 84450	13	9 99015	25	10 00985	9 85436	12	39
22	9 84463	13	9 99040	25	10 00960	9 85423	12	38
23	9 84476	13	9 99065	25	10 00935	9 85411	12	37
24	9 84489	13	9 99090	25	10 00910	9 85399	12	36
25	9 84502	13	9 99116	25	10 00884	9 85386	12	35
26	9 84515	13	9 99141	25	10 00859	9 85374	12	34
27	9 84528	13	9 99166	25	10 00834	9 85361	12	33
28	9 84540	13	9 99191	25	10 00809	9 85349	12	32
29	9 84553	13	9 99217	25	10 00783	9 85337	12	31
30	9 84566	13	9 99242	25	10 00758	9 85324	12	30
	Cosine		Cotang.		Tangent.	Sine.		

[45 degrees.]

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	
30	9 84566	13	9 99242	25	10 00758	9 85324	12	30
31	9 84579	13	9 99267	25	10 00733	9 85312	12	29
32	9 84592	13	9 99293	25	10 00707	9 85299	12	28
33	9 84605	13	9 99318	25	10 00682	9 85287	12	27
34	9 84618	12	9 99343	25	10 00657	9 85274	12	26
35	9 84630	13	9 99368	25	10 00631	9 85262	12	25
36	9 84643	13	9 99394	25	10 00606	9 85250	12	24
37	9 84656	13	9 99419	25	10 00581	9 85237	12	23
38	9 84669	13	9 99444	25	10 00555	9 85225	12	22
39	9 84682	12	9 99469	25	10 00531	9 85212	12	21
40	9 84694	13	9 99495	25	10 00505	9 85200	12	20
41	9 84707	13	9 99520	25	10 00480	9 85187	12	19
42	9 84720	13	9 99545	25	10 00455	9 85175	12	18
43	9 84733	12	9 99570	25	10 00430	9 85162	12	17
44	9 84745	13	9 99596	25	10 00404	9 85150	12	16
45	9 84758	13	9 99621	25	10 00379	9 85137	12	15
46	9 84771	13	9 99646	25	10 00354	9 85125	12	14
47	9 84784	12	9 99672	25	10 00328	9 85112	12	13
48	9 84796	13	9 99697	25	10 00303	9 85100	12	12
49	9 84809	13	9 99722	25	10 00278	9 85087	12	11
50	9 84822	13	9 99747	25	10 00253	9 85074	12	10
51	9 84835	12	9 99773	25	10 00227	9 85062	12	9
52	9 84847	13	9 99798	25	10 00202	9 85049	12	8
53	9 84860	13	9 99823	25	10 00177	9 85037	12	7
54	9 84873	12	9 99848	25	10 00152	9 85024	12	6
55	9 84886	13	9 99874	25	10 00126	9 85012	12	5
56	9 84898	13	9 99899	25	10 00101	9 84999	12	4
57	9 84911	12	9 99924	25	10 00076	9 84986	12	3
58	9 84923	13	9 99949	25	10 00051	9 84974	12	2
59	9 84936	13	9 99975	25	10 00025	9 84961	12	1
60	9 84949	13	10 00000	25	10 00000	9 84949	12	0
	Cosine		Cotang.		Tangent.	Sine.		

[45 degrees.]



**TABLES OF RIGHT ASCENSION,  
DECLINATION, AND ASCENSIONAL  
DIFFERENCE**





ARIES AND LIBRA			ASCENSIONAL DIFFERENCE		
Deg.	Declin.	Rt. Ascen.	London	Birm'g'm	Liverpool
°	° ' "	° ' "	° ' "	° ' "	° ' "
0	0 0	0 0	0 0	0 0	0 0
1	0 24	0 55	0 30	0 31	0 32
2	0 48	1 50	1 0	1 2	1 4
3	1 12	2 45	1 30	1 33	1 37
4	1 36	3 40	2 0	2 4	2 9
5	1 59	4 35	2 30	2 35	2 41
<hr/>					
6	2 23	5 30	3 0	3 6	3 13
7	2 47	6 26	3 30	3 37	3 45
8	3 10	7 21	4 0	4 8	4 17
9	3 34	8 16	4 30	4 39	4 49
10	3 58	9 11	5 0	5 10	5 21
<hr/>					
11	4 21	10 7	5 30	5 41	5 53
12	4 45	11 2	6 0	6 12	6 25
13	5 8	11 58	6 30	6 43	6 57
14	5 31	12 53	7 0	7 14	7 29
15	5 55	13 49	7 29	7 45	8 1
<hr/>					
16	6 18	14 44	7 59	8 16	8 33
17	6 41	15 40	8 29	8 46	9 5
18	7 4	16 36	8 58	9 17	9 37
19	7 27	17 32	9 28	9 48	10 8
20	7 49	18 28	9 57	10 18	10 40
<hr/>					
21	8 12	19 24	10 27	10 49	11 12
22	8 34	20 20	10 56	11 19	11 43
23	8 57	21 17	11 26	11 49	12 15
24	9 19	22 13	11 55	12 20	12 46
25	9 41	23 10	12 24	12 50	13 17
<hr/>					
26	10 3	24 6	12 53	13 20	13 49
27	10 24	25 8	13 22	13 50	14 20
28	10 46	26 0	13 51	14 20	14 51
29	11 7	26 57	14 20	14 50	15 22
30	11 29	27 55	14 48	15 19	15 53

☞ For the R.A. of Libra add 180° to the same degree of Aries. The Declin. and Asc. Diff. are the same for both.

TAURUS AND SCORPIO						ASCENSIONAL DIFFERENCE					
Deg.	Declin.		Rt. Ascen.		London	Birm'g'm		Liverpool			
°	°	'	°	'	°	'	°	'	°	'	
0	11	29	27	55	14	48	15	19	15	53	
1	11	50	28	52	15	17	15	49	16	28	
2	12	10	29	49	15	45	16	19	16	54	
3	12	31	30	47	16	14	16	48	17	24	
4	12	51	31	45	16	42	17	17	17	55	
5	18	12	32	43	17	10	17	46	18	25	
6	18	32	33	41	17	38	18	15	18	55	
7	18	51	34	39	18	5	18	44	19	25	
8	14	11	35	38	18	33	19	12	19	54	
9	14	30	36	37	19	0	19	41	20	24	
10	14	49	37	35	19	27	20	9	20	53	
11	15	8	38	34	19	54	20	37	21	22	
12	15	27	39	33	20	21	21	5	21	51	
13	15	45	40	33	20	47	21	32	22	20	
14	16	8	41	32	21	14	21	59	22	48	
15	16	21	42	32	21	40	22	26	23	16	
16	16	38	43	32	22	5	22	53	23	44	
17	16	55	44	32	22	31	23	20	24	12	
18	17	12	45	32	22	56	23	46	24	39	
19	17	29	46	33	23	21	24	12	25	6	
20	17	45	47	33	23	46	24	37	25	33	
21	18	1	48	34	24	10	25	8	25	59	
22	18	17	49	35	24	34	25	28	26	25	
23	18	32	50	36	24	57	25	52	26	51	
24	18	47	51	37	25	21	26	16	27	16	
25	19	1	52	39	25	48	26	40	27	41	
26	19	16	53	40	26	6	27	4	28	5	
27	19	30	54	42	26	28	27	27	28	29	
28	19	43	55	44	26	49	27	49	28	53	
29	19	57	56	47	27	11	28	11	29	16	
30	20	10	57	49	27	31	28	33	29	39	

For R.A. of Scorpio add 180° to the same degree of Taurus. The Declin. and Asc. Diff. are the same for both.

GEMINI & SAGITTARIUS					ASCENSIONAL DIFFERENCE						
Deg.		Declin.		Rt. Ascen.		London		Birming'm		Liverpool	
°	'	°	'	°	'	°	'	°	'	°	'
0	20	10		57	49	27	31	28	33	29	39
1	20	22		58	52	27	52	28	54	30	1
2	20	35		59	54	28	12	29	15	30	23
3	20	46		60	57	28	31	29	35	30	44
4	20	57		62	0	28	49	29	54	31	4
5	21	8		63	3	29	8	30	13	31	24
6	21	19		64	7	29	25	30	32	31	43
7	21	29		65	10	29	42	30	50	32	2
8	21	39		66	14	29	59	31	7	32	20
9	21	49		67	18	30	15	31	23	32	37
10	21	58		68	22	30	30	31	40	32	54
11	22	6		69	26	30	45	31	55	33	10
12	22	14		70	30	30	58	32	9	33	26
13	22	22		71	34	31	11	32	23	33	40
14	22	29		72	39	31	24	32	37	33	54
15	22	36		73	43	31	36	32	49	34	7
16	22	43		74	48	31	48	33	1	34	20
17	22	49		75	52	31	58	33	12	34	31
18	22	55		76	57	32	8	33	22	34	42
19	23	0		78	2	32	17	33	32	34	52
20	23	4		79	7	32	25	33	41	35	1
21	23	9		80	12	32	33	33	49	35	10
22	23	18		81	17	32	40	33	56	35	17
23	23	16		82	22	32	46	34	2	35	24
24	23	19		83	28	32	51	34	7	35	30
25	23	21		84	33	32	55	34	12	35	35
26	23	23		85	38	32	59	34	16	35	39
27	23	25		86	44	33	2	34	19	35	42
28	23	26		87	49	33	4	34	21	35	44
29	23	27		88	55	33	5	34	22	35	45
30	23	27		90	0	33	6	34	23	35	46

☞ For the R.A. of Sagittarius add 180° to the same degree of Gemini. The Declin. and Asc. Diff. are the same for both.

CANCER AND CAPRICORNUS			ASCENSIONAL DIFFERENCE		
Deg.	Declin.	Rt. Ascen.	London	Birming'm	Liverpool
°	° ' "	° ' "	° ' "	° ' "	° ' "
0	28 27	90 0	88 6	84 28	85 46
1	28 27	91 5	88 5	84 22	85 45
2	28 26	92 11	88 4	84 21	85 44
3	28 25	93 16	88 2	84 19	85 42
4	28 23	94 22	82 59	84 16	85 39
5	28 21	95 27	82 55	84 12	85 35
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6	28 19	96 32	82 51	84 7	85 30
7	28 16	97 38	82 46	84 2	85 24
8	28 13	98 43	82 40	83 56	85 17
9	28 9	99 48	82 33	83 49	85 10
10	28 4	100 53	82 25	83 41	85 1
<hr/>					
11	28 0	101 58	82 17	83 32	84 52
12	22 55	103 3	82 8	83 22	84 42
13	22 49	104 8	81 58	83 12	84 31
14	22 43	105 12	81 48	83 1	84 20
15	22 36	106 17	81 36	82 49	84 7
<hr/>					
16	22 29	107 21	81 24	82 37	83 54
17	22 22	108 26	81 11	82 28	83 40
18	22 14	109 30	80 58	82 9	83 26
19	22 6	110 34	80 45	81 55	83 10
20	21 58	111 38	80 30	81 40	82 54
<hr/>					
21	21 49	112 42	80 15	81 28	82 37
22	21 39	113 46	29 59	81 7	82 20
23	21 29	114 50	29 42	80 50	82 2
24	21 19	115 53	29 25	80 32	81 48
25	21 8	116 57	29 8	80 18	81 24
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26	20 57	118 0	28 49	29 54	81 4
27	20 46	119 3	28 31	29 35	80 44
28	20 35	120 6	28 12	29 15	80 28
29	20 22	121 8	27 52	28 54	80 1
30	20 10	122 11	27 31	28 33	29 39

☞ For the R.A. of Capricornus add 180° to the same degree of Cancer. The Declin. and Asc. Diff. are the same for both.

LEO AND AQUARIUS			ASCENSIONAL DIFFERENCE		
Deg.	Declin.	Rt. Ascen.	London	Birming'm	Liverpool
°	° ' "	° ' "	° ' "	° ' "	° ' "
0	20 10	122 11	27 31	28 33	29 39
1	19 57	123 18	27 11	28 11	29 16
2	19 48	124 16	26 49	27 49	28 53
3	19 30	125 18	26 28	27 27	28 29
4	19 16	126 20	26 6	27 4	28 5
5	19 1	127 21	25 43	26 40	27 41
6	18 47	128 23	25 21	26 16	27 16
7	18 32	129 24	24 57	25 52	26 51
8	18 17	130 25	24 34	25 28	26 25
9	18 1	131 26	24 10	25 3	25 59
10	17 45	132 27	23 46	24 37	25 33
11	17 29	133 27	23 21	24 12	25 6
12	17 12	134 28	22 56	23 46	24 39
13	16 55	135 28	22 31	23 20	24 12
14	16 38	136 28	22 5	22 53	23 44
15	16 21	137 28	21 40	22 26	23 16
16	16 3	138 28	21 14	21 59	22 48
17	15 45	139 27	20 47	21 32	22 20
18	15 27	140 27	20 21	21 5	21 51
19	15 8	141 26	19 54	20 37	21 22
20	14 49	142 25	19 27	20 9	20 53
21	14 30	143 23	19 0	19 41	20 24
22	14 11	144 22	18 33	19 12	19 54
23	13 51	145 21	18 5	18 44	19 25
24	13 32	146 19	17 38	18 15	18 55
25	13 12	147 17	17 10	17 46	18 25
26	12 51	148 15	16 42	17 17	17 55
27	12 31	149 13	16 14	16 48	17 24
28	12 10	150 11	15 45	16 19	16 54
29	11 50	151 8	15 17	15 49	16 23
30	11 29	152 5	14 48	15 19	15 53

For the R.A. of Aquarius add 180° to the same degree of Leo. The Declin. and Asc. Diff. are the same for both.

VIRGO AND PISCES				ASCENSIONAL DIFFERENCE							
Deg.		Declin.		Rt. Ascen.		London		Birm'ng'm		Liverpool	
°	'	°	'	°	'	°	'	°	'	°	'
0	11	29	152	5	14	48	15	19	15	58	
1	11	7	153	8	14	20	14	50	15	22	
2	10	46	154	0	18	51	14	20	14	51	
3	10	24	154	57	18	22	18	50	14	20	
4	10	8	155	54	12	53	18	20	18	49	
5	9	41	156	50	12	24	12	50	18	17	
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6	9	19	157	47	11	55	12	20	12	46	
7	8	57	158	43	11	26	11	49	12	15	
8	8	34	159	40	10	56	11	19	11	43	
9	8	12	160	36	10	27	10	49	11	12	
10	7	49	161	32	9	57	10	18	10	40	
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11	7	27	162	28	9	28	9	48	10	8	
12	7	4	163	24	8	58	9	17	9	37	
13	6	41	164	20	8	29	8	46	9	5	
14	6	18	165	16	7	59	8	16	8	33	
15	5	55	166	11	7	29	7	45	8	1	
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16	5	31	167	7	7	0	7	14	7	29	
17	5	8	168	2	6	30	6	43	6	57	
18	4	45	168	58	6	0	6	12	6	25	
19	4	21	169	53	5	30	5	41	5	53	
20	3	58	170	49	5	0	5	10	5	21	
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21	3	34	171	44	4	30	4	39	4	49	
22	3	10	172	39	4	0	4	8	4	17	
23	2	47	173	34	3	30	3	37	3	45	
24	2	23	174	30	3	0	3	6	3	13	
25	1	59	175	25	2	30	2	35	2	41	
<hr/>											
26	1	36	176	20	2	0	2	4	2	9	
27	1	12	177	15	1	30	1	33	1	37	
28	0	48	178	10	1	0	1	2	1	4	
29	0	24	179	5	0	30	0	31	0	32	
30	0	0	180	0	0	0	0	0	0	0	

For the R.A. of Pisces add 180° to the same degree of Virgo. The Declin. and Asc. Diff. are the same for both.

**TERNARY PROPORTIONAL  
LOGARITHMS**





# TERNARY PROPORTIONAL LOGARITHMS

	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°
1	Infinite	2'25527	1'95424	1'77815	1'65321	1'55630	1'47712	1'41017	1'35218	1'30103
0	4'03342	2'24809	1'95064	1'77575	1'65141	1'55486	1'47592	1'40914	1'35128	1'30023
2	3'73239	2'24103	1'94706	1'77335	1'64961	1'55342	1'47472	1'40811	1'35038	1'29942
3	3'55630	2'23408	1'94352	1'77097	1'64782	1'55198	1'47352	1'40708	1'34948	1'29862
4	3'43136	2'22724	1'94000	1'76861	1'64603	1'55055	1'47232	1'40606	1'34858	1'29782
5	3'33445	2'22051	1'93651	1'76625	1'64426	1'54912	1'47113	1'40503	1'34768	1'29703
6	3'25527	2'21388	1'93305	1'76391	1'64249	1'54770	1'46994	1'40404	1'34679	1'29623
7	3'18833	2'20735	1'92962	1'76158	1'64073	1'54629	1'46876	1'40300	1'34589	1'29544
8	3'13033	2'20091	1'92621	1'75927	1'63897	1'54487	1'46758	1'40198	1'34500	1'29464
9	3'07918	2'19457	1'92283	1'75696	1'63722	1'54347	1'46640	1'40097	1'34411	1'29385
10	3'03342	2'18833	1'91948	1'75467	1'63548	1'54206	1'46522	1'39996	1'34323	1'29306
11	2'99203	2'18217	1'91615	1'75239	1'63375	1'54066	1'46404	1'39895	1'34234	1'29227
12	2'95442	2'17609	1'91285	1'75012	1'63202	1'53927	1'46288	1'39794	1'34146	1'29148
13	2'91948	2'17010	1'90957	1'74787	1'63030	1'53788	1'46171	1'39694	1'34058	1'29070
14	2'88730	2'16419	1'90632	1'74562	1'62859	1'53649	1'46055	1'39593	1'33970	1'28991
15	2'85733	2'15836	1'90309	1'74339	1'62688	1'53511	1'45938	1'39493	1'33882	1'28913
16	2'82930	2'15261	1'89988	1'74117	1'62518	1'53374	1'45824	1'39394	1'33794	1'28835
17	2'80297	2'14693	1'89670	1'73896	1'62349	1'53236	1'45708	1'39294	1'33707	1'28757
18	2'77815	2'14133	1'89354	1'73676	1'62180	1'53100	1'45593	1'39195	1'33619	1'28679
19	2'75467	2'13580	1'89041	1'73457	1'62012	1'52963	1'45478	1'39096	1'33532	1'28601
20	2'73239	2'13033	1'88730	1'73239	1'61845	1'52827	1'45364	1'38997	1'33445	1'28524
21	2'71120	2'12494	1'88420	1'73023	1'61678	1'52692	1'45250	1'38899	1'33359	1'28446
22	2'69100	2'11961	1'88114	1'72807	1'61512	1'52557	1'45136	1'38800	1'33272	1'28368
23	2'67170	2'11435	1'87809	1'72593	1'61347	1'52422	1'45022	1'38702	1'33186	1'28292
24	2'65321	2'10914	1'87506	1'72379	1'61182	1'52288	1'44909	1'38604	1'33099	1'28215
25	2'63548	2'10400	1'87206	1'72167	1'61018	1'52154	1'44796	1'38506	1'33013	1'28138
26	2'61845	2'09893	1'86907	1'71956	1'60854	1'52021	1'44684	1'38409	1'32927	1'28061
27	2'60206	2'09390	1'86611	1'71745	1'60691	1'51888	1'44571	1'38312	1'32842	1'27984
28	2'58627	2'08894	1'86316	1'71536	1'60529	1'51755	1'44459	1'38215	1'32756	1'27908
29	2'57103	2'08403	1'86024	1'71328	1'60367	1'51623	1'44347	1'38118	1'32671	1'27831
30	2'55630	2'07918	1'85733	1'71120	1'60206	1'51491	1'44236	1'38021	1'32585	1'27755
31	2'54206	2'07438	1'85445	1'70914	1'60045	1'51360	1'44125	1'37925	1'32500	1'27679
32	2'52827	2'06964	1'85158	1'70709	1'59885	1'51229	1'44014	1'37829	1'32415	1'27603
33	2'51491	2'06494	1'84873	1'70504	1'59726	1'51098	1'43903	1'37733	1'32331	1'27527
34	2'50194	2'06030	1'84590	1'70301	1'59567	1'50963	1'43793	1'37637	1'32246	1'27451
35	2'48936	2'05570	1'84309	1'70099	1'59409	1'50838	1'43683	1'37541	1'32162	1'27376
36	2'47712	2'05115	1'84030	1'69897	1'59251	1'50708	1'43573	1'37446	1'32077	1'27300
37	2'46524	2'04665	1'83752	1'69696	1'59094	1'50579	1'43463	1'37351	1'31993	1'27225
38	2'45361	2'04220	1'83477	1'69497	1'58938	1'50451	1'43354	1'37256	1'31909	1'27150
39	2'44236	2'03779	1'83203	1'69298	1'58782	1'50322	1'43245	1'37161	1'31826	1'27075
40	2'43136	2'03342	1'82930	1'69100	1'58627	1'50194	1'43136	1'37067	1'31742	1'27000
41	2'42064	2'02910	1'82660	1'68903	1'58472	1'50067	1'43028	1'36972	1'31659	1'26925
42	2'41017	2'02482	1'82391	1'68707	1'58317	1'49940	1'42920	1'36878	1'31575	1'26850
43	2'39996	2'02060	1'82124	1'68512	1'58164	1'49813	1'42812	1'36784	1'31492	1'26776
44	2'38997	2'01639	1'81858	1'68318	1'58011	1'49687	1'42704	1'36691	1'31409	1'26701
45	2'38021	2'01223	1'81594	1'68124	1'57858	1'49560	1'42597	1'36597	1'31326	1'26627
46	2'37067	2'00812	1'81332	1'67932	1'57706	1'49435	1'42490	1'36504	1'31244	1'26553
47	2'36133	2'00404	1'81071	1'67740	1'57554	1'49309	1'42383	1'36411	1'31161	1'26479
48	2'35218	2'00000	1'80811	1'67549	1'57403	1'49184	1'42276	1'36318	1'31079	1'26405
49	2'34323	1'99600	1'80554	1'67359	1'57253	1'49060	1'42170	1'36225	1'30997	1'26331
50	2'33445	1'99203	1'80297	1'67170	1'57103	1'48936	1'42064	1'36133	1'30915	1'26257
51	2'32585	1'98810	1'80043	1'66981	1'56953	1'48812	1'41958	1'36040	1'30833	1'26184
52	2'31742	1'98421	1'79790	1'66794	1'56804	1'48688	1'41853	1'35948	1'30751	1'26110
53	2'30915	1'98035	1'79538	1'66607	1'56656	1'48565	1'41747	1'35856	1'30670	1'26037
54	2'30103	1'97652	1'79287	1'66421	1'56508	1'48442	1'41642	1'35765	1'30588	1'25964
55	2'29306	1'97273	1'79039	1'66236	1'56360	1'48320	1'41538	1'35673	1'30507	1'25891
56	2'28524	1'96897	1'78791	1'66051	1'56213	1'48197	1'41433	1'35582	1'30426	1'25818
57	2'27755	1'96524	1'78545	1'65868	1'56067	1'48076	1'41329	1'35491	1'30345	1'25745
58	2'27000	1'96154	1'78300	1'65683	1'55921	1'47954	1'41225	1'35400	1'30264	1'25672
59	2'26257	1'95788	1'78057	1'65503	1'55775	1'47833	1'41121	1'35309	1'30183	1'25600
60	2'25527	1'95424	1'77815	1'65321	1'55630	1'47712	1'41017	1'35218	1'30103	1'25527

# TERNARY PROPORTIONAL LOGARITHMS

	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°
0	1'25527	1'21388	1'17609	1'14133	1'10914	1'07918	1'05115	1'02482	1'00000	0'97652
1	1'25453	1'21322	1'17549	1'14077	1'10863	1'07870	1'05070	1'02440	0'99960	0'97614
2	1'25383	1'21257	1'17489	1'14022	1'10811	1'07822	1'05025	1'02397	0'99920	0'97576
3	1'25311	1'21191	1'17429	1'13966	1'10760	1'07774	1'04980	1'02355	0'99880	0'97538
4	1'25239	1'21126	1'17369	1'13911	1'10708	1'07726	1'04935	1'02312	0'99839	0'97500
5	1'25167	1'21060	1'17309	1'13855	1'10657	1'07678	1'04890	1'02270	0'99799	0'97462
6	1'25095	1'20995	1'17249	1'13800	1'10605	1'07630	1'04845	1'02228	0'99759	0'97424
7	1'25024	1'20930	1'17189	1'13745	1'10554	1'07582	1'04800	1'02185	0'99719	0'97386
8	1'24952	1'20865	1'17129	1'13690	1'10503	1'07534	1'04755	1'02143	0'99679	0'97348
9	1'24881	1'20800	1'17070	1'13635	1'10452	1'07486	1'04710	1'02101	0'99640	0'97310
10	1'24809	1'20735	1'17010	1'13580	1'10400	1'07438	1'04665	1'02059	0'99600	0'97273
11	1'24738	1'20670	1'16951	1'13525	1'10349	1'07391	1'04620	1'02017	0'99560	0'97235
12	1'24667	1'20605	1'16891	1'13470	1'10298	1'07343	1'04576	1'01974	0'99520	0'97197
13	1'24596	1'20541	1'16832	1'13415	1'10247	1'07295	1'04531	1'01932	0'99480	0'97159
14	1'24526	1'20476	1'16773	1'13360	1'10197	1'07248	1'04486	1'01890	0'99441	0'97122
15	1'24455	1'20412	1'16714	1'13306	1'10146	1'07200	1'04442	1'01848	0'99401	0'97084
16	1'24384	1'20348	1'16655	1'13251	1'10095	1'07153	1'04397	1'01806	0'99361	0'97047
17	1'24314	1'20284	1'16596	1'13197	1'10044	1'07105	1'04353	1'01764	0'99322	0'97009
18	1'24244	1'20219	1'16537	1'13142	1'09994	1'07058	1'04308	1'01723	0'99282	0'96972
19	1'24173	1'20155	1'16478	1'13088	1'09943	1'07011	1'04264	1'01681	0'99243	0'96934
20	1'24103	1'20091	1'16419	1'13033	1'09893	1'06964	1'04220	1'01639	0'99203	0'96897
21	1'24033	1'20028	1'16361	1'12979	1'09842	1'06916	1'04175	1'01597	0'99164	0'96859
22	1'23963	1'19964	1'16302	1'12925	1'09792	1'06869	1'04131	1'01556	0'99124	0'96822
23	1'23894	1'19900	1'16243	1'12871	1'09741	1'06822	1'04087	1'01515	0'99085	0'96784
24	1'23824	1'19837	1'16185	1'12817	1'09691	1'06775	1'04043	1'01472	0'99045	0'96747
25	1'23754	1'19773	1'16127	1'12763	1'09641	1'06728	1'03999	1'01431	0'99006	0'96710
26	1'23685	1'19710	1'16068	1'12709	1'09591	1'06681	1'03955	1'01389	0'98967	0'96673
27	1'23616	1'19647	1'16010	1'12655	1'09540	1'06634	1'03911	1'01348	0'98928	0'96635
28	1'23546	1'19584	1'15952	1'12601	1'09490	1'06588	1'03867	1'01306	0'98888	0'96598
29	1'23477	1'19520	1'15894	1'12548	1'09440	1'06541	1'03823	1'01265	0'98849	0'96561
30	1'23408	1'19457	1'15836	1'12494	1'09390	1'06494	1'03779	1'01223	0'98810	0'96524
31	1'23339	1'19395	1'15778	1'12440	1'09341	1'06447	1'03735	1'01182	0'98771	0'96487
32	1'23271	1'19332	1'15721	1'12387	1'09291	1'06401	1'03691	1'01141	0'98732	0'96450
33	1'23202	1'19269	1'15663	1'12333	1'09241	1'06354	1'03647	1'01100	0'98693	0'96413
34	1'23133	1'19206	1'15605	1'12280	1'09191	1'06308	1'03604	1'01058	0'98654	0'96376
35	1'23065	1'19144	1'15548	1'12227	1'09142	1'06261	1'03560	1'01017	0'98615	0'96339
36	1'22997	1'19081	1'15490	1'12173	1'09092	1'06215	1'03516	1'00976	0'98576	0'96302
37	1'22928	1'19019	1'15433	1'12120	1'09042	1'06168	1'03473	1'00935	0'98537	0'96265
38	1'22860	1'18957	1'15375	1'12067	1'08993	1'06122	1'03429	1'00894	0'98498	0'96228
39	1'22792	1'18895	1'15318	1'12014	1'08943	1'06076	1'03386	1'00853	0'98459	0'96191
40	1'22724	1'18833	1'15261	1'11961	1'08894	1'06030	1'03342	1'00812	0'98421	0'96154
41	1'22657	1'18771	1'15204	1'11908	1'08845	1'05983	1'03299	1'00771	0'98382	0'96117
42	1'22589	1'18709	1'15147	1'11855	1'08796	1'05937	1'03256	1'00730	0'98343	0'96081
43	1'22521	1'18647	1'15090	1'11802	1'08746	1'05891	1'03212	1'00689	0'98304	0'96044
44	1'22454	1'18585	1'15033	1'11750	1'08697	1'05845	1'03169	1'00648	0'98266	0'96007
45	1'22386	1'18523	1'14976	1'11697	1'08648	1'05799	1'03126	1'00607	0'98227	0'95971
46	1'22319	1'18462	1'14919	1'11644	1'08599	1'05753	1'03083	1'00567	0'98189	0'95934
47	1'22252	1'18400	1'14863	1'11592	1'08550	1'05707	1'03039	1'00526	0'98150	0'95897
48	1'22185	1'18339	1'14806	1'11539	1'08501	1'05660	1'02996	1'00485	0'98111	0'95860
49	1'22118	1'18278	1'14750	1'11487	1'08452	1'05616	1'02953	1'00443	0'98073	0'95824
50	1'22051	1'18217	1'14693	1'11435	1'08403	1'05570	1'02910	1'00404	0'98035	0'95788
51	1'21984	1'18155	1'14637	1'11382	1'08355	1'05524	1'02867	1'00363	0'97996	0'95751
52	1'21918	1'18094	1'14581	1'11330	1'08306	1'05479	1'02824	1'00323	0'97958	0'95715
53	1'21851	1'18033	1'14524	1'11278	1'08257	1'05434	1'02781	1'00282	0'97919	0'95678
54	1'21785	1'17973	1'14468	1'11226	1'08209	1'05388	1'02739	1'00242	0'97881	0'95642
55	1'21718	1'17912	1'14412	1'11174	1'08160	1'05342	1'02696	1'00202	0'97843	0'95606
56	1'21652	1'17851	1'14356	1'11122	1'08112	1'05297	1'02653	1'00161	0'97805	0'95569
57	1'21586	1'17790	1'14300	1'11070	1'08063	1'05251	1'02610	1'00121	0'97766	0'95533
58	1'21520	1'17730	1'14244	1'11018	1'08015	1'05206	1'02568	1'00080	0'97728	0'95497
59	1'21454	1'17669	1'14189	1'10966	1'07966	1'05161	1'02525	1'00040	0'97690	0'95460
60	1'21388	1'17609	1'14133	1'10914	1'07918	1'05115	1'02482	1'00000	0'97652	0'95424

# TERNARY PROPORTIONAL LOGARITHMS

	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°
1	93424	93305	91285	89354	87506	85733	84030	82391	80811	79287
0	93388	93271	91252	89323	87476	85704	84002	82364	80786	79262
2	93352	93236	91219	89292	87446	85675	83974	82337	80760	79238
3	93316	93202	91186	89260	87416	85646	83946	82311	80734	79213
4	93280	93168	91154	89229	87386	85618	83919	82284	80708	79188
5	93244	93133	91121	89197	87356	85589	83891	82257	80682	79163
6	93208	93099	91088	89166	87326	85560	83863	82230	80657	79138
7	93172	93065	91055	89135	87296	85531	83835	82204	80631	79113
8	93136	93030	91023	89103	87266	85502	83808	82177	80605	79088
9	93100	92996	90990	89072	87236	85473	83780	82150	80579	79063
10	93064	92962	90957	89041	87206	85445	83752	82124	80554	79039
11	93028	92928	90925	89010	87176	85416	83725	82097	80528	79014
12	94092	92894	90892	88978	87146	85387	83697	82070	80502	78989
13	94056	92860	90859	88947	87116	85358	83670	82044	80477	78964
14	94021	92825	90827	88916	87086	85330	83642	82017	80451	78939
15	94885	92791	90794	88885	87056	85301	83614	81991	80425	78915
16	94849	92757	90762	88854	87026	85272	83587	81964	80400	78890
17	94813	92723	90729	88823	86996	85244	83559	81938	80374	78865
18	94778	92689	90697	88792	86967	85215	83532	81911	80349	78840
19	94742	92655	90664	88761	86937	85187	83504	81884	80323	78816
20	94706	92621	90632	88730	86907	85158	83477	81858	80297	78791
21	94671	92587	90599	88699	86877	85129	83449	81832	80272	78766
22	94635	92554	90567	88668	86848	85101	83422	81805	80246	78742
23	94600	92520	90535	88637	86818	85072	83394	81779	80221	78717
24	94564	92486	90502	88606	86788	85044	83367	81752	80195	78693
25	94529	92452	90470	88575	86759	85015	83339	81726	80170	78668
26	94493	92418	90438	88544	86729	84987	83312	81699	80144	78643
27	94458	92385	90406	88513	86699	84958	83285	81673	80119	78619
28	94423	92351	90373	88482	86670	84930	83257	81647	80094	78594
29	94387	92317	90341	88451	86640	84902	83230	81620	80068	78570
30	94352	92283	90309	88420	86611	84873	83203	81594	80043	78545
31	94317	92250	90277	88390	86581	84845	83175	81568	80017	78521
32	94281	92216	90245	88359	86552	84816	83148	81541	79992	78496
33	94246	92183	90213	88328	86522	84788	83121	81515	79967	78472
34	94211	92149	90181	88297	86493	84760	83094	81489	79941	78447
35	94176	92115	90148	88267	86463	84732	83066	81463	79916	78423
36	94141	92082	90116	88236	86434	84703	83039	81436	79891	78398
37	94105	92048	90084	88205	86404	84675	83012	81410	79865	78374
38	94070	92015	90052	88175	86375	84647	82985	81384	79840	78349
39	94035	91981	90020	88144	86346	84619	82958	81358	79815	78325
40	94000	91948	89988	88114	86316	84590	82930	81332	79790	78300
41	93965	91915	89957	88083	86287	84562	82903	81305	79764	78276
42	93930	91881	89925	88052	86258	84534	82876	81279	79739	78252
43	93895	91848	89893	88022	86228	84506	82849	81253	79714	78227
44	93860	91815	89861	87991	86199	84478	82822	81227	79689	78203
45	93825	91781	89829	87961	86170	84450	82795	81201	79663	78179
46	93791	91748	89797	87930	86140	84421	82768	81175	79638	78154
47	93756	91715	89766	87900	86111	84393	82741	81149	79613	78130
48	93721	91682	89734	87870	86082	84365	82714	81123	79588	78106
49	93686	91648	89702	87839	86053	84337	82687	81097	79563	78081
50	93651	91615	89670	87809	86024	84309	82660	81071	79538	78057
51	93617	91582	89639	87778	85995	84281	82633	81045	79513	78033
52	93582	91549	89607	87748	85965	84253	82606	81019	79488	78009
53	93547	91516	89575	87718	85936	84225	82579	80993	79463	77984
54	93513	91483	89544	87687	85907	84197	82552	80967	79437	77960
55	93478	91450	89512	87657	85878	84169	82525	80941	79412	77936
56	93443	91417	89481	87627	85849	84141	82498	80915	79387	77912
57	93409	91384	89449	87597	85820	84114	82471	80889	79362	77888
58	93374	91351	89417	87566	85791	84086	82445	80863	79337	77863
59	93340	91318	89386	87536	85762	84058	82418	80837	79312	77839
60	93305	91285	89354	87506	85733	84030	82391	80811	79287	77815

# TERNARY PROPORTIONAL LOGARITHMS

	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°
0	77815	76391	75012	73676	72379	71120	69897	68707	67549	66421
1	77791	76368	74990	73654	72358	71100	69877	68688	67530	66402
2	77767	76344	74967	73632	72337	71079	69857	68668	67511	66384
3	77743	76321	74944	73610	72316	71058	69837	68648	67492	66365
4	77719	76298	74922	73588	72294	71038	69817	68629	67473	66347
5	77695	76274	74899	73566	72273	71017	69797	68609	67454	66328
6	77671	76251	74877	73544	72252	70997	69777	68590	67435	66310
7	77647	76228	74854	73523	72231	70976	69756	68570	67416	66291
8	77623	76205	74832	73501	72209	70955	69736	68551	67397	66273
9	77599	76181	74809	73479	72188	70935	69716	68531	67378	66254
10	77575	76158	74787	73457	72167	70914	69696	68512	67359	66236
11	77551	76135	74764	73435	72146	70894	69676	68492	67340	66217
12	77527	76112	74742	73413	72125	70873	69656	68473	67321	66199
13	77503	76089	74719	73392	72103	70852	69636	68454	67302	66180
14	77479	76065	74697	73370	72082	70832	69616	68434	67283	66162
15	77455	76042	74674	73348	72061	70811	69596	68415	67264	66143
16	77431	76019	74652	73326	72040	70791	69576	68395	67245	66125
17	77407	75996	74629	73305	72019	70770	69557	68376	67226	66106
18	77383	75973	74607	73283	71998	70750	69537	68356	67207	66088
19	77359	75950	74585	73261	71977	70729	69517	68337	67188	66070
20	77335	75927	74562	73239	71956	70709	69497	68318	67170	66051
21	77311	75903	74540	73218	71935	70688	69477	68298	67151	66033
22	77288	75880	74517	73196	71914	70668	69457	68279	67132	66014
23	77264	75857	74495	73174	71892	70647	69437	68259	67113	65996
24	77240	75834	74473	73153	71871	70627	69417	68240	67094	65978
25	77216	75811	74450	73131	71850	70606	69397	68221	67075	65959
26	77192	75788	74428	73109	71829	70586	69377	68201	67056	65941
27	77169	75765	74406	73088	71808	70566	69358	68182	67038	65923
28	77145	75742	74383	73066	71787	70545	69338	68163	67019	65904
29	77121	75719	74361	73044	71766	70525	69318	68143	67000	65886
30	77097	75696	74339	73023	71745	70504	69298	68124	66981	65868
31	77074	75673	74317	73001	71724	70484	69278	68105	66962	65849
32	77050	75650	74294	72980	71703	70464	69258	68086	66944	65831
33	77026	75627	74272	72958	71682	70443	69239	68066	66925	65813
34	77002	75604	74250	72936	71662	70423	69219	68047	66906	65794
35	76979	75581	74228	72915	71641	70403	69199	68028	66887	65776
36	76955	75559	74205	72893	71620	70382	69179	68008	66869	65758
37	76931	75536	74183	72872	71599	70362	69159	67989	66850	65739
38	76908	75513	74161	72850	71578	70342	69140	67970	66831	65721
39	76884	75490	74139	72829	71557	70321	69120	67951	66812	65703
40	76861	75467	74117	72807	71536	70301	69100	67932	66794	65685
41	76837	75444	74095	72786	71515	70281	69080	67912	66775	65666
42	76813	75421	74072	72764	71494	70260	69061	67893	66756	65648
43	76790	75398	74050	72743	71473	70240	69041	67874	66737	65630
44	76766	75376	74028	72721	71453	70220	69021	67855	66719	65612
45	76743	75353	74006	72700	71432	70200	69002	67836	66700	65594
46	76719	75330	73984	72678	71411	70179	68982	67816	66681	65575
47	76696	75307	73962	72657	71390	70159	68962	67797	66663	65557
48	76672	75285	73940	72636	71369	70139	68942	67778	66644	65539
49	76649	75262	73918	72614	71349	70119	68923	67759	66625	65521
50	76625	75239	73896	72593	71328	70099	68903	67740	66607	65503
51	76602	75216	73874	72571	71307	70078	68884	67721	66588	65484
52	76578	75194	73852	72550	71286	70058	68864	67702	66570	65466
53	76555	75171	73830	72529	71265	70038	68844	67682	66551	65448
54	76531	75148	73808	72507	71245	70018	68825	67663	66532	65430
55	76508	75126	73786	72486	71224	69998	68805	67644	66514	65412
56	76485	75103	73764	72465	71203	69977	68785	67625	66495	65394
57	76461	75080	73742	72443	71183	69957	68766	67606	66477	65376
58	76438	75058	73720	72422	71162	69937	68746	67587	66458	65357
59	76414	75035	73698	72401	71141	69917	68727	67568	66439	65339
60	76391	75012	73676	72379	71120	69897	68707	67549	66421	65321

# TERNARY PROPORTIONAL LOGARITHMS

	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°
0	65321	64249	63202	62180	61182	60206	59251	58317	57403	56508
1	65303	64231	63185	62164	61166	60190	59236	58302	57388	56493
2	65285	64214	63168	62147	61149	60174	59220	58287	57373	56478
3	65267	64196	63151	62130	61133	60158	59204	58271	57358	56463
4	65249	64178	63133	62113	61116	60142	59189	58256	57343	56449
5	65231	64161	63116	62096	61100	60126	59173	58241	57328	56434
6	65213	64143	63099	62080	61083	60110	59157	58225	57313	56419
7	65195	64125	63082	62063	61067	60094	59141	58210	57298	56404
8	65177	64108	63065	62046	61051	60078	59126	58194	57283	56390
9	65159	64090	63047	62029	61034	60061	59110	58179	57268	56375
10	65141	64073	63030	62012	61018	60045	59094	58164	57253	56360
11	65123	64055	63013	61996	61001	60029	59079	58148	57238	56345
12	65105	64038	62996	61979	60985	60013	59063	58133	57223	56331
13	65087	64020	62979	61962	60969	59997	59047	58118	57208	56316
14	65069	64002	62962	61945	60952	59981	59031	58102	57193	56301
15	65051	63985	62945	61929	60936	59965	59016	58087	57178	56287
16	65033	63967	62927	61912	60920	59949	59000	58072	57163	56272
17	65015	63950	62910	61895	60903	59933	58985	58056	57154	56257
18	64997	63932	62893	61878	60887	59917	58969	58041	57133	56243
19	64979	63915	62876	61862	60871	59901	58954	58026	57118	56228
20	64961	63897	62859	61845	60854	59885	58938	58011	57103	56213
21	64943	63880	62842	61828	60838	59870	58922	57995	57088	56199
22	64925	63862	62825	61812	60822	59854	58907	57980	57073	56184
23	64907	63845	62808	61795	60805	59838	58891	57965	57058	56169
24	64889	63827	62791	61778	60789	59822	58875	57949	57043	56155
25	64871	63810	62774	61762	60773	59806	58860	57934	57028	56140
26	64853	63792	62757	61745	60756	59790	58844	57919	57013	56125
27	64835	63775	62739	61728	60740	59774	58829	57904	56998	56111
28	64818	63757	62722	61712	60724	59758	58813	57888	56983	56096
29	64800	63740	62705	61695	60708	59742	58798	57873	56968	56081
30	64782	63722	62688	61678	60691	59726	58782	57858	56953	56067
31	64764	63705	62671	61662	60675	59710	58766	57843	56938	56052
32	64746	63688	62654	61645	60659	59694	58751	57827	56923	56037
33	64728	63670	62637	61628	60642	59678	58735	57812	56908	56023
34	64710	63653	62620	61612	60626	59663	58720	57797	56893	56008
35	64692	63635	62603	61595	60610	59647	58704	57782	56879	55994
36	64675	63618	62586	61579	60594	59631	58689	57767	56864	55979
37	64657	63601	62569	61562	60578	59615	58673	57751	56849	55964
38	64639	63583	62552	61545	60561	59599	58658	57736	56834	55950
39	64621	63566	62535	61529	60545	59583	58642	57721	56819	55935
40	64603	63548	62518	61512	60529	59567	58627	57706	56804	55921
41	64586	63531	62501	61496	60513	59551	58611	57691	56789	55906
42	64568	63514	62484	61479	60496	59536	58596	57675	56774	55892
43	64550	63496	62468	61463	60480	59520	58580	57660	56759	55877
44	64532	63479	62451	61446	60464	59504	58565	57645	56745	55862
45	64514	63462	62434	61429	60448	59488	58549	57630	56730	55848
46	64497	63444	62417	61413	60432	59472	58534	57615	56715	55833
47	64479	63427	62400	61396	60416	59457	58518	57596	56696	55819
48	64461	63410	62383	61380	60399	59441	58503	57584	56685	55804
49	64443	63392	62366	61363	60383	59425	58487	57569	56670	55790
50	64426	63375	62349	61347	60367	59409	58472	57554	56656	55775
51	64408	63358	62332	61330	60351	59393	58456	57539	56641	55761
52	64390	63340	62315	61314	60335	59378	58441	57524	56626	55746
53	64373	63323	62298	61297	60319	59362	58425	57509	56611	55732
54	64355	63306	62282	61281	60303	59346	58410	57494	56596	55717
55	64337	63289	62265	61264	60286	59330	58395	57479	56582	55703
56	64320	63271	62248	61248	60270	59314	58379	57463	56567	55688
57	64302	63254	62231	61231	60254	59299	58364	57448	56552	55674
58	64284	63237	62214	61215	60238	59283	58348	57433	56537	55659
59	64267	63220	62197	61198	60222	59267	58333	57418	56522	55645
60	64249	63202	62180	61182	60206	59251	58317	57403	56508	55630

# TERNARY PROPORTIONAL LOGARITHMS

	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°
0	53630	54770	53927	53100	52288	51491	50708	49940	49184	48442
1	53616	54756	53913	53086	52274	51478	50696	49927	49172	48430
2	53601	54742	53899	53072	52261	51465	50683	49914	49159	48418
3	53587	54728	53885	53059	52248	51452	50670	49902	49147	48405
4	53572	54714	53871	53045	52234	51438	50657	49889	49135	48393
5	53558	54699	53857	53031	52221	51425	50644	49876	49122	48381
6	53543	54685	53843	53018	52208	51412	50631	49864	49110	48369
7	53529	54671	53830	53004	52194	51399	50618	49851	49097	48356
8	53515	54657	53816	52991	52181	51386	50605	49838	49085	48344
9	53500	54643	53802	52977	52167	51373	50592	49826	49072	48332
10	53486	54629	53788	52963	52154	51360	50579	49813	49060	48320
11	53471	54614	53774	52950	52141	51346	50566	49800	49047	48307
12	53457	54600	53760	52936	52127	51333	50554	49788	49035	48295
13	53442	54586	53746	52922	52114	51320	50541	49775	49023	48283
14	53428	54572	53732	52909	52101	51307	50528	49762	49010	48271
15	53414	54558	53719	52895	52087	51294	50515	49750	48998	48258
16	53399	54544	53705	52882	52074	51281	50502	49737	48985	48246
17	53385	54530	53691	52868	52061	51268	50489	49724	48973	48234
18	53370	54516	53677	52855	52047	51255	50476	49712	48960	48222
19	53356	54501	53663	52841	52034	51242	50464	49699	48948	48210
20	53342	54487	53649	52827	52021	51229	50451	49687	48936	48197
21	53327	54473	53636	52814	52007	51215	50438	49674	48923	48185
22	53313	54459	53622	52800	51994	51202	50425	49661	48911	48173
23	53299	54445	53608	52787	51981	51189	50412	49649	48898	48161
24	53284	54431	53594	52773	51967	51176	50399	49636	48886	48149
25	53270	54417	53580	52760	51954	51163	50387	49623	48874	48136
26	53255	54403	53567	52746	51941	51150	50374	49611	48861	48124
27	53241	54389	53553	52732	51927	51137	50361	49598	48849	48112
28	53227	54375	53539	52719	51914	51124	50348	49586	48836	48100
29	53212	54361	53525	52705	51901	51111	50335	49573	48824	48088
30	53198	54347	53511	52692	51888	51098	50322	49560	48812	48076
31	53184	54332	53498	52678	51874	51085	50310	49548	48799	48063
32	53169	54318	53484	52665	51861	51072	50297	49535	48787	48051
33	53155	54304	53470	52651	51848	51059	50284	49523	48775	48039
34	53141	54290	53456	52638	51835	51046	50271	49510	48762	48027
35	53127	54276	53442	52624	51821	51033	50258	49498	48750	48015
36	53112	54262	53429	52611	51808	51020	50246	49485	48737	48003
37	53098	54248	53415	52597	51795	51007	50233	49472	48725	47990
38	53084	54234	53401	52584	51781	50994	50220	49460	48713	47978
39	53069	54220	53387	52570	51768	50981	50207	49447	48700	47966
40	53055	54206	53374	52557	51755	50968	50194	49435	48688	47954
41	53041	54192	53360	52543	51742	50955	50182	49422	48676	47942
42	53026	54178	53346	52530	51729	50942	50169	49410	48663	47930
43	53012	54164	53332	52516	51715	50929	50156	49397	48651	47918
44	52998	54150	53319	52503	51702	50916	50143	49385	48639	47906
45	52984	54136	53305	52489	51689	50903	50131	49372	48626	47893
46	52969	54122	53291	52476	51676	50890	50118	49360	48614	47881
47	52955	54108	53278	52462	51662	50877	50105	49347	48602	47869
48	52941	54094	53264	52449	51649	50864	50092	49334	48590	47857
49	52927	54080	53250	52436	51636	50851	50080	49322	48577	47845
50	52912	54066	53236	52422	51623	50838	50067	49309	48565	47833
51	52898	54052	53223	52409	51610	50825	50054	49297	48553	47821
52	52884	54038	53209	52395	51596	50812	50041	49284	48540	47809
53	52870	54024	53195	52382	51583	50799	50029	49272	48528	47797
54	52855	54011	53182	52368	51570	50786	50016	49259	48516	47785
55	52841	53997	53168	52355	51557	50773	50003	49247	48503	47772
56	52827	53983	53154	52342	51544	50760	49991	49234	48491	47760
57	52813	53969	53141	52328	51530	50747	49978	49222	48479	47748
58	52799	53955	53127	52315	51517	50734	49965	49209	48467	47736
59	52784	53941	53113	52301	51504	50721	49952	49197	48454	47724
60	52770	53927	53100	52288	51491	50708	49940	49184	48442	47712

# TERNARY PROPORTIONAL LOGARITHMS

	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°
0	47712	46994	46288	45593	44909	44236	43573	42920	42276	41642	41017	40401
1	47700	46982	46276	45582	44898	44225	43562	42909	42266	41632	41007	40391
2	47688	46971	46265	45570	44887	44214	43551	42898	42255	41621	40997	40381
3	47676	46959	46253	45559	44875	44203	43540	42887	42244	41611	40986	40371
4	47664	46947	46241	45547	44864	44191	43529	42877	42234	41600	40976	40361
5	47652	46935	46230	45536	44853	44180	43518	42866	42223	41590	40966	40350
6	47640	46923	46218	45524	44841	44169	43507	42855	42213	41579	40955	40340
7	47628	46911	46206	45513	44830	44158	43496	42844	42202	41569	40945	40330
8	47616	46899	46195	45501	44819	44147	43485	42833	42191	41559	40935	40320
9	47604	46888	46183	45490	44808	44136	43474	42823	42181	41548	40924	40310
10	47592	46876	46171	45478	44796	44125	43463	42812	42170	41538	40914	40300
11	47580	46864	46160	45467	44785	44114	43452	42801	42159	41527	40904	40289
12	47568	46852	46148	45456	44774	44102	43441	42790	42149	41517	40894	40279
13	47556	46840	46137	45444	44762	44091	43431	42780	42138	41506	40883	40269
14	47544	46828	46125	45433	44751	44080	43420	42769	42128	41496	40873	40259
15	47532	46817	46113	45421	44740	44069	43409	42758	42117	41485	40863	40249
16	47520	46805	46102	45410	44729	44058	43398	42747	42106	41475	40852	40239
17	47508	46793	46090	45398	44717	44047	43387	42737	42096	41464	40842	40228
18	47496	46781	46078	45387	44706	44036	43376	42726	42085	41454	40832	40218
19	47484	46769	46067	45375	44695	44025	43365	42715	42075	41443	40821	40208
20	47472	46758	46055	45364	44684	44014	43354	42704	42064	41433	40811	40198
21	47460	46746	46044	45353	44672	44003	43343	42693	42053	41423	40801	40188
22	47448	46734	46032	45341	44661	43993	43332	42683	42043	41413	40791	40178
23	47436	46722	46020	45330	44650	43981	43321	42672	42032	41402	40780	40168
24	47424	46710	46009	45318	44639	43969	43310	42661	42022	41391	40770	40157
25	47412	46699	45997	45307	44627	43958	43300	42651	42011	41381	40760	40147
26	47400	46687	45986	45295	44616	43947	43289	42640	42000	41370	40749	40137
27	47388	46675	45974	45284	44605	43936	43278	42629	41990	41360	40739	40127
28	47376	46663	45962	45273	44594	43925	43267	42618	41979	41350	40729	40117
29	47364	46652	45951	45261	44583	43914	43256	42608	41969	41339	40719	40107
30	47352	46640	45939	45250	44571	43903	43245	42597	41958	41329	40708	40097
31	47340	46628	45928	45238	44560	43892	43234	42586	41948	41318	40698	40087
32	47328	46616	45916	45227	44549	43881	43223	42575	41937	41308	40688	40076
33	47316	46604	45905	45216	44538	43870	43212	42565	41927	41298	40678	40066
34	47304	46593	45893	45204	44526	43859	43202	42554	41916	41287	40667	40056
35	47292	46581	45881	45193	44515	43848	43191	42543	41905	41277	40657	40046
36	47280	46569	45870	45182	44504	43837	43180	42533	41895	41266	40647	40036
37	47268	46557	45858	45170	44493	43826	43169	42522	41884	41256	40637	40026
38	47256	46546	45847	45159	44482	43815	43158	42511	41874	41246	40626	40016
39	47244	46534	45835	45147	44470	43804	43147	42500	41863	41235	40616	40006
40	47232	46522	45824	45136	44459	43793	43136	42490	41853	41225	40606	39996
41	47220	46510	45812	45125	44448	43782	43126	42479	41842	41214	40596	39985
42	47208	46499	45800	45113	44437	43771	43115	42468	41832	41204	40585	39975
43	47196	46487	45789	45102	44426	43760	43104	42458	41821	41194	40575	39965
44	47185	46475	45777	45091	44414	43749	43093	42447	41811	41183	40565	39955
45	47173	46464	45766	45079	44403	43738	43082	42436	41800	41173	40555	39945
46	47161	46452	45754	45068	44392	43727	43071	42426	41789	41162	40544	39935
47	47149	46440	45743	45057	44381	43716	43060	42415	41779	41152	40534	39925
48	47137	46428	45731	45045	44370	43705	43050	42404	41768	41142	40524	39915
49	47125	46417	45720	45034	44359	43694	43039	42394	41758	41131	40514	39905
50	47113	46405	45708	45022	44347	43683	43028	42383	41747	41121	40503	39895
51	47101	46393	45697	45011	44336	43672	43017	42372	41737	41111	40493	39885
52	47089	46382	45688	45000	44325	43661	43006	42362	41726	41100	40483	39874
53	47077	46370	45674	44988	44314	43650	42995	42351	41716	41090	40473	39864
54	47066	46358	45662	44977	44303	43639	42985	42340	41705	41080	40463	39854
55	47054	46346	45651	44966	44292	43628	42974	42330	41695	41069	40453	39844
56	47042	46335	45639	44955	44280	43617	42963	42319	41684	41059	40442	39834
57	47030	46323	45628	44943	44269	43606	42952	42308	41674	41048	40432	39824
58	47018	46311	45616	44932	44258	43595	42941	42298	41663	41038	40422	39814
59	47006	46300	45605	44921	44247	43584	42931	42287	41653	41028	40412	39804
60	46994	46288	45593	44909	44236	43573	42920	42276	41642	41017	40401	39794

# TERNARY PROPORTIONAL LOGARITHMS

	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°
0	39794	39195	38604	38021	37446	36878	36318	35765	35218	34679	34146	33619
1	39784	39185	38594	38011	37436	36869	36309	35755	35209	34670	34137	33611
2	39774	39175	38585	38002	37427	36860	36299	35745	35200	34661	34128	33602
3	39764	39165	38575	37992	37417	36850	36290	35737	35191	34652	34119	33593
4	39754	39155	38565	37982	37408	36841	36281	35728	35182	34643	34111	33587
5	39744	39145	38555	37973	37398	36831	36271	35719	35173	34634	34102	33576
6	39734	39136	38545	37963	37389	36822	36262	35710	35164	34625	34093	33567
7	39724	39126	38536	37954	37379	36812	36253	35700	35155	34616	34084	33558
8	39714	39116	38526	37944	37370	36803	36244	35691	35146	34607	34075	33550
9	39704	39106	38516	37934	37360	36794	36234	35682	35137	34598	34066	33541
10	39694	39096	38506	37925	37351	36784	36225	35673	35128	34589	34058	33532
11	39684	39086	38497	37915	37341	36775	36216	35664	35119	34581	34049	33524
12	39674	39076	38487	37905	37332	36766	36207	35655	35110	34572	34040	33515
13	39664	39066	38477	37896	37322	36756	36197	35646	35101	34563	34031	33506
14	39653	39055	38467	37886	37311	36747	36188	35636	35092	34554	34022	33497
15	39643	39046	38458	37877	37303	36737	36179	35627	35083	34545	34014	33489
16	39633	39037	38448	37867	37294	36728	36170	35618	35074	34536	34005	33480
17	39623	39027	38438	37857	37284	36719	36160	35609	35065	34527	33996	33471
18	39613	39017	38428	37848	37275	36709	36151	35600	35056	34518	33987	33463
19	39603	39007	38419	37838	37265	36700	36142	35591	35047	34509	33978	33454
20	39593	38997	38409	37829	37256	36691	36133	35582	35038	34500	33970	33445
21	39583	38987	38399	37819	37246	36681	36123	35573	35029	34491	33961	33437
22	39573	38977	38389	37809	37237	36672	36114	35563	35020	34483	33952	33428
23	39563	38968	38380	37800	37227	36663	36105	35554	35011	34474	33943	33419
24	39553	38958	38370	37790	37218	36653	36096	35545	35002	34465	33935	33411
25	39543	38948	38360	37781	37208	36644	36086	35536	34993	34456	33926	33402
26	39533	38938	38351	37771	37199	36634	36077	35527	34984	34447	33917	33393
27	39523	38928	38341	37761	37189	36625	36068	35518	34975	34438	33908	33385
28	39513	38918	38331	37752	37180	36616	36059	35509	34966	34429	33899	33376
29	39503	38908	38321	37742	37171	36606	36050	35500	34957	34420	33891	33367
30	39493	38899	38312	37733	37161	36597	36040	35491	34948	34411	33882	33359
31	39483	38889	38302	37723	37152	36588	36031	35481	34939	34402	33873	33350
32	39473	38879	38292	37713	37142	36578	36022	35472	34930	34393	33864	33341
33	39464	38869	38282	37704	37133	36569	36013	35463	34921	34385	33856	33333
34	39454	38859	38273	37694	37123	36560	36003	35454	34912	34376	33847	33324
35	39444	38849	38263	37685	37114	36550	35994	35445	34903	34367	33838	33315
36	39434	38839	38253	37675	37104	36541	35985	35436	34894	34358	33829	33307
37	39424	38830	38244	37665	37095	36532	35976	35427	34885	34349	33820	33298
38	39414	38820	38234	37656	37085	36522	35967	35418	34876	34340	33812	33289
39	39404	38810	38224	37646	37076	36513	35957	35409	34867	34332	33803	33281
40	39394	38800	38215	37637	37067	36504	35948	35400	34858	34323	33794	33272
41	39384	38790	38205	37627	37057	36494	35939	35391	34849	34314	33785	33263
42	39374	38781	38195	37618	37048	36485	35930	35381	34840	34305	33777	33255
43	39364	38771	38186	37608	37038	36476	35921	35372	34831	34296	33768	33246
44	39354	38761	38176	37599	37029	36467	35911	35363	34822	34287	33759	33237
45	39344	38751	38166	37589	37019	36457	35902	35354	34813	34278	33750	33229
46	39334	38741	38156	37579	37010	36448	35893	35345	34804	34270	33742	33220
47	39324	38731	38147	37570	37001	36439	35884	35336	34795	34261	33733	33211
48	39314	38722	38137	37560	36991	36429	35875	35327	34786	34252	33724	33203
49	39304	38712	38127	37551	36982	36420	35866	35318	34777	34243	33715	33194
50	39294	38702	38118	37541	36972	36411	35856	35309	34768	34234	33707	33186
51	39284	38692	38108	37532	36963	36401	35847	35300	34759	34225	33698	33177
52	39274	38682	38098	37522	36953	36392	35838	35291	34750	34217	33689	33168
53	39264	38673	38089	37513	36944	36383	35829	35282	34741	34208	33681	33160
54	39254	38663	38079	37503	36935	36374	35820	35273	34732	34199	33672	33151
55	39245	38653	38069	37494	36925	36364	35810	35264	34723	34190	33663	33142
56	39235	38643	38060	37484	36916	36355	35801	35254	34715	34182	33654	33134
57	39225	38633	38050	37474	36906	36346	35792	35245	34706	34172	33646	33125
58	39215	38624	38040	37465	36897	36336	35783	35236	34697	34164	33637	33117
59	39205	38614	38031	37455	36888	36327	35774	35227	34688	34155	33628	33108
60	39195	38604	38021	37446	36879	36318	35765	35218	34679	34146	33619	33099



# TERNARY PROPORTIONAL LOGARITHMS

	84°	85°	86°	87°	88°	89°	90°	91°	92°	93°	94°	95°
0	33099	32585	32077	31575	31079	30588	30103	29623	29148	28679	28214	27755
1	33091	32577	32069	31567	31071	30580	30095	29615	29141	28671	28207	27747
2	33082	32568	32061	31559	31063	30572	30087	29607	29133	28663	28199	27740
3	33073	32560	32052	31550	31054	30564	30079	29599	29125	28656	28191	27732
4	33065	32551	32044	31542	31046	30556	30071	29591	29117	28648	28184	27724
5	33056	32543	32035	31534	31038	30548	30063	29583	29109	28640	28176	27717
6	33048	32534	32027	31525	31030	30539	30055	29575	29101	28632	28168	27709
7	33039	32526	32019	31517	31021	30531	30047	29567	29093	28625	28161	27702
8	33030	32517	32010	31509	31013	30523	30039	29560	29086	28617	28153	27694
9	33022	32509	32002	31501	31005	30515	30031	29552	29078	28609	28145	27686
10	33013	32500	31993	31492	30997	30507	30023	29544	29070	28601	28138	27679
11	33005	32492	31985	31484	30989	30499	30015	29536	29062	28593	28130	27671
12	32996	32483	31977	31476	30980	30491	30007	29528	29054	28586	28122	27664
13	32987	32475	31968	31467	30972	30483	29999	29520	29046	28578	28114	27656
14	32979	32466	31960	31459	30964	30475	29991	29512	29038	28570	28107	27648
15	32970	32458	31951	31451	30956	30466	29983	29504	29031	28562	28099	27641
16	32962	32449	31943	31442	30948	30458	29975	29496	29023	28555	28091	27633
17	32953	32441	31935	31434	30939	30450	29967	29488	29015	28547	28084	27626
18	32944	32432	31926	31426	30931	30442	29958	29480	29007	28539	28076	27618
19	32936	32424	31918	31418	30923	30434	29950	29472	28999	28531	28068	27610
20	32927	32415	31909	31409	30915	30426	29942	29464	28991	28524	28061	27603
21	32919	32407	31901	31401	30907	30418	29934	29456	28984	28516	28053	27595
22	32910	32398	31893	31393	30898	30410	29926	29448	28976	28508	28045	27588
23	32902	32390	31884	31384	30890	30302	29918	29441	28968	28500	28038	27580
24	32893	32381	31876	31376	30882	30393	29910	29433	28960	28493	28030	27572
25	32884	32373	31867	31368	30874	30385	29902	29425	28952	28485	28022	27565
26	32876	32365	31859	31360	30866	30377	29894	29417	28944	28477	28015	27557
27	32867	32356	31851	31351	30857	30369	29886	29409	28937	28469	28007	27550
28	32859	32348	31842	31343	30849	30361	29878	29401	28929	28462	27999	27542
29	32850	32339	31834	31335	30841	30353	29870	29393	28921	28454	27992	27534
30	32842	32331	31826	31326	30833	30345	29862	29385	28913	28446	27984	27527
31	32833	32322	31817	31318	30825	30337	29854	29377	28905	28438	27976	27519
32	32824	32314	31809	31310	30817	30329	29846	29369	28897	28431	27969	27512
33	32816	32305	31801	31302	30808	30321	29838	29361	28889	28423	27961	27504
34	32807	32297	31792	31293	30800	30313	29830	29354	28882	28415	27953	27497
35	32799	32288	31784	31285	30792	30305	29822	29346	28874	28407	27946	27489
36	32790	32280	31775	31277	30784	30296	29814	29338	28866	28400	27938	27481
37	32782	32271	31767	31269	30776	30288	29806	29330	28858	28392	27930	27474
38	32773	32263	31759	31260	30768	30280	29798	29322	28851	28384	27923	27466
39	32765	32255	31750	31252	30759	30272	29790	29314	28843	28376	27915	27459
40	32756	32246	31742	31244	30751	30264	29782	29306	28835	28369	27908	27451
41	32747	32238	31734	31236	30743	30256	29775	29298	28827	28361	27900	27444
42	32739	32229	31725	31227	30735	30248	29767	29290	28819	28353	27892	27436
43	32730	32221	31717	31219	30727	30240	29759	29282	28811	28346	27885	27429
44	32722	32212	31709	31211	30719	30232	29751	29275	28804	28338	27877	27424
45	32713	32204	31700	31203	30710	30224	29743	29267	28796	28330	27869	27413
46	32705	32195	31692	31194	30702	30216	29735	29259	28788	28322	27862	27406
47	32696	32187	31684	31186	30694	30208	29727	29251	28780	28315	27854	27398
48	32688	32179	31675	31178	30686	30200	29719	29243	28772	28307	27846	27391
49	32679	32170	31667	31170	30678	30192	29711	29235	28765	28299	27839	27383
50	32671	32162	31659	31161	30670	30183	29703	29227	28757	28292	27831	27376
51	32662	32153	31650	31153	30662	30175	29695	29219	28749	28284	27824	27368
52	32654	32145	31642	31145	30653	30167	29687	29211	28741	28276	27816	27360
53	32645	32136	31634	31137	30645	30159	29679	29204	28733	28268	27808	27353
54	32636	32128	31625	31128	30637	30151	29671	29196	28726	28261	27801	27345
55	32628	32120	31617	31120	30629	30143	29663	29188	28718	28253	27793	27338
56	32619	32111	31609	31112	30621	30135	29655	29180	28710	28245	27785	27330
57	32611	32103	31600	31104	30613	30127	29647	29172	28702	28237	27778	27323
58	32602	32094	31592	31095	30605	30119	29639	29164	28695	28230	27770	27315
59	32594	32086	31584	31087	30596	30111	29631	29156	28687	28222	27763	27308
60	32585	32077	31575	31079	30588	30103	29623	29148	28679	28214	27755	27300

# TERNARY PROPORTIONAL LOGARITHMS

	96°	97°	98°	99°	100°	101°	102°	103°	104°	105°	106°	107°
0	27300	26850	26405	25964	25527	25095	24667	24244	23824	23408	22997	22589
1	27293	26843	26397	25956	25520	25088	24660	24237	23817	23401	22990	22582
2	27285	26835	26390	25949	25513	25081	24653	24230	23810	23395	22983	22575
3	27278	26828	26382	25942	25506	25074	24646	24222	23803	23388	22976	22569
4	27270	26820	26375	25934	25498	25066	24639	24215	23796	23381	22969	22562
5	27262	26813	26368	25927	25491	25059	24632	24208	23789	23374	22963	22555
6	27255	26805	26360	25920	25484	25052	24625	24201	23782	23367	22956	22548
7	27247	26798	26353	25913	25477	25045	24618	24194	23775	23360	22949	22542
8	27240	26790	26346	25905	25469	25038	24610	24187	23768	23353	22942	22535
9	27232	26783	26338	25898	25462	25031	24603	24180	23761	23346	22935	22528
10	27225	26776	26331	25891	25455	25024	24596	24173	23754	23339	22928	22521
11	27217	26768	26323	25883	25448	25016	24589	24166	23747	23333	22922	22515
12	27210	26761	26316	25876	25440	25009	24582	24159	23740	23326	22915	22508
13	27202	26753	26309	25869	25433	25002	24575	24152	23734	23319	22908	22501
14	27195	26746	26301	25861	25426	24995	24568	24145	23727	23312	22899	22494
15	27187	26738	26294	25854	25419	24988	24561	24138	23720	23305	22894	22488
16	27180	26731	26287	25847	25412	24981	24554	24131	23713	23298	22888	22481
17	27172	26723	26279	25840	25404	24973	24547	24124	23706	23291	22881	22474
18	27165	26716	26272	25832	25397	24966	24540	24117	23699	23284	22874	22467
19	27157	26709	26265	25825	25390	24959	24533	24110	23692	23278	22867	22461
20	27150	26701	26257	25818	25383	24952	24526	24103	23685	23271	22860	22454
21	27142	26694	26250	25810	25376	24945	24518	24096	23678	23264	22854	22447
22	27135	26686	26242	25803	25368	24938	24511	24089	23671	23257	22847	22440
23	27127	26679	26235	25796	25361	24931	24504	24082	23664	23250	22840	22434
24	27120	26671	26228	25789	25354	24923	24497	24075	23657	23243	22833	22427
25	27112	26664	26220	25781	25347	24916	24490	24068	23650	23236	22826	22420
26	27105	26656	26213	25774	25339	24909	24483	24061	23643	23229	22819	22413
27	27097	26649	26206	25767	25332	24902	24476	24054	23636	23222	22813	22407
28	27090	26642	26198	25759	25325	24895	24469	24047	23629	23216	22806	22400
29	27082	26634	26191	25752	25318	24888	24462	24040	23623	23209	22799	22393
30	27075	26627	26184	25745	25311	24881	24455	24033	23616	23202	22792	22386
31	27067	26619	26176	25738	25303	24874	24448	24026	23609	23195	22785	22380
32	27060	26612	26169	25730	25296	24866	24441	24019	23602	23188	22779	22373
33	27052	26605	26162	25723	25289	24859	24434	24012	23595	23181	22772	22366
34	27045	26597	26154	25716	25282	24852	24427	24005	23588	23175	22765	22359
35	27037	26590	26147	25709	25275	24845	24420	23998	23581	23168	22758	22353
36	27030	26582	26140	25701	25267	24838	24413	23991	23574	23161	22752	22346
37	27022	26575	26132	25694	25260	24831	24405	23984	23567	23154	22745	22339
38	27015	26567	26125	25687	25253	24824	24398	23977	23560	23147	22738	22333
39	27007	26560	26118	25680	25246	24817	24391	23970	23553	23140	22731	22326
40	27000	26553	26110	25672	25239	24809	24384	23963	23546	23133	22724	22319
41	26992	26545	26103	25665	25231	24802	24377	23956	23539	23127	22718	22312
42	26985	26538	26096	25658	25224	24795	24370	23949	23533	23120	22711	22306
43	26977	26530	26088	25650	25217	24788	24363	23942	23526	23113	22704	22299
44	26970	26523	26081	25643	25210	24781	24356	23935	23519	23106	22697	22292
45	26962	26516	26074	25636	25203	24774	24349	23928	23512	23099	22690	22286
46	26955	26508	26066	25629	25196	24767	24342	23921	23505	23092	22684	22279
47	26947	26501	26059	25621	25188	24760	24335	23914	23498	23086	22677	22272
48	26940	26493	26052	25614	25181	24752	24328	23908	23491	23079	22670	22265
49	26932	26486	26044	25607	25174	24745	24321	23901	23484	23072	22663	22259
50	26925	26479	26037	25600	25167	24738	24314	23894	23477	23065	22657	22252
51	26917	26471	26030	25592	25160	24731	24307	23887	23470	23058	22650	22245
52	26910	26464	26022	25585	25152	24724	24300	23880	23464	23051	22643	22239
53	26902	26456	26015	25578	25145	24717	24293	23873	23457	23044	22636	22232
54	26895	26449	26008	25571	25138	24710	24286	23866	23450	23038	22629	22225
55	26887	26442	26000	25563	25131	24703	24279	23859	23443	23031	22623	22218
56	26880	26434	25993	25556	25124	24696	24272	23852	23436	23024	22616	22212
57	26872	26427	25986	25549	25117	24689	24265	23845	23429	23017	22609	22205
58	26865	26419	25978	25542	25109	24681	24258	23838	23422	23010	22602	22198
59	26858	26412	25971	25534	25102	24674	24251	23831	23415	23004	22596	22192
60	26850	26405	25964	25527	25095	24667	24244	23824	23408	22997	22589	22185

# TERNARY PROPORTIONAL LOGARITHMS

	108°	109°	110°	111°	112°	113°	114°	115°	116°	117°	118°	119°
1	22185	21785	21388	20995	20605	20219	19837	19457	19081	18709	18339	17973
0	22178	21778	21381	20988	20599	20213	19830	19451	19075	18702	18333	17966
2	22171	21771	21375	20982	20593	20207	19824	19445	19069	18696	18327	17960
3	22165	21765	21368	20975	20586	20200	19818	19439	19063	18690	18321	17954
4	22158	21758	21362	20969	20580	20194	19811	19432	19056	18684	18315	17948
5	22151	21751	21355	20962	20573	20187	19805	19426	19050	18678	18308	17942
6	22145	21745	21349	20956	20567	20181	19799	19420	19044	18672	18302	17936
7	22138	21738	21342	20949	20560	20175	19792	19413	19038	18665	18296	17930
8	22131	21731	21335	20943	20554	20168	19786	19407	19032	18659	18290	17924
9	22125	21725	21329	20936	20547	20162	19780	19401	19025	18653	18284	17918
10	22118	21718	21322	20930	20541	20155	19773	19395	19019	18647	18278	17912
11	22111	21712	21316	20923	20534	20149	19767	19388	19013	18641	18272	17906
12	22105	21705	21309	20917	20528	20143	19761	19382	19007	18634	18266	17900
13	22098	21698	21303	20910	20522	20136	19754	19376	19000	18628	18259	17894
14	22091	21692	21296	20904	20515	20130	19748	19369	18994	18622	18253	17887
15	22084	21685	21289	20897	20509	20123	19742	19363	18988	18616	18247	17881
16	22078	21678	21283	20891	20502	20117	19735	19357	18982	18610	18241	17875
17	22071	21672	21276	20884	20496	20111	19729	19351	18976	18604	18235	17869
18	22064	21665	21270	20878	20489	20104	19723	19344	18969	18597	18229	17863
19	22058	21659	21263	20871	20483	20098	19716	19338	18963	18591	18223	17857
20	22051	21652	21257	20865	20476	20091	19710	19332	18957	18585	18217	17851
21	22044	21645	21250	20858	20470	20085	19704	19325	18951	18579	18210	17845
22	22038	21639	21243	20852	20464	20079	19697	19319	18944	18573	18204	17839
23	22031	21632	21237	20845	20457	20072	19691	19313	18938	18567	18198	17833
24	22024	21626	21230	20839	20451	20066	19685	19307	18932	18560	18192	17827
25	22018	21619	21224	20832	20444	20060	19678	19300	18926	18554	18186	17821
26	22011	21612	21217	20826	20438	20053	19672	19294	18920	18548	18180	17815
27	22004	21606	21211	20819	20431	20047	19666	19288	18913	18542	18174	17809
28	21998	21599	21204	20813	20425	20040	19659	19282	18907	18536	18168	17803
29	21991	21592	21198	20806	20418	20034	19653	19275	18901	18530	18162	17797
30	21984	21586	21191	20800	20412	20028	19647	19269	18895	18523	18155	17790
31	21978	21579	21184	20793	20406	20021	19640	19263	18888	18517	18149	17784
32	21971	21573	21178	20787	20399	20015	19634	19257	18882	18511	18143	17778
33	21964	21566	21171	20780	20393	20009	19628	19250	18876	18505	18137	17772
34	21958	21559	21165	20774	20386	20002	19621	19244	18870	18499	18131	17766
35	21951	21553	21158	20767	20380	19996	19615	19238	18864	18493	18125	17760
36	21944	21546	21152	20761	20373	19989	19609	19231	18857	18487	18119	17754
37	21938	21540	21145	20754	20367	19983	19602	19225	18851	18480	18113	17748
38	21931	21533	21139	20748	20361	19977	19596	19219	18845	18474	18107	17742
39	21924	21526	21132	20741	20354	19970	19590	19213	18839	18468	18100	17736
40	21918	21520	21126	20735	20348	19964	19584	19206	18833	18462	18094	17730
41	21911	21513	21119	20728	20341	19958	19577	19200	18826	18456	18088	17724
42	21904	21507	21112	20722	20335	19951	19571	19194	18820	18450	18082	17718
43	21898	21500	21106	20715	20328	19945	19565	19188	18814	18443	18076	17712
44	21891	21493	21099	20709	20322	19938	19558	19181	18808	18437	18070	17706
45	21884	21487	21093	20702	20316	19932	19552	19175	18802	18431	18064	17700
46	21878	21480	21086	20696	20309	19926	19546	19169	18795	18425	18058	17694
47	21871	21474	21080	20690	20303	19919	19539	19163	18789	18419	18052	17688
48	21864	21467	21073	20683	20296	19913	19533	19156	18783	18413	18046	17682
49	21858	21460	21067	20676	20290	19907	19527	19150	18777	18407	18040	17676
50	21851	21454	21060	20670	20284	19900	19520	19144	18771	18400	18033	17669
51	21844	21447	21054	20664	20277	19894	19514	19138	18764	18394	18027	17663
52	21838	21441	21047	20657	20271	19888	19508	19131	18758	18388	18021	17657
53	21831	21434	21041	20651	20264	19881	19502	19125	18752	18382	18015	17651
54	21824	21427	21034	20644	20258	19875	19495	19119	18746	18376	18009	17645
55	21818	21421	21028	20638	20251	19869	19489	19113	18740	18370	18003	17639
56	21811	21414	21021	20631	20245	19862	19483	19106	18733	18364	17997	17633
57	21805	21408	21015	20625	20239	19856	19476	19100	18727	18357	17991	17627
58	21798	21401	21008	20618	20232	19849	19470	19094	18721	18351	17985	17621
59	21791	21395	21001	20612	20226	19843	19464	19088	18715	18345	17979	17615
60	21785	21388	20995	20605	20219	19837	19457	19081	18709	18339	17973	17609

# TERNARY PROPORTIONAL LOGARITHMS

	120°	121°	122°	123°	124°	125°	126°	127°	128°	129°	130°	131°
0	17609	17249	16891	16537	16185	15836	15490	15147	14806	14468	14133	13800
1	17603	17243	16885	16531	16179	15830	15484	15141	14801	14463	14127	13795
2	17597	17237	16879	16525	16173	15825	15479	15135	14795	14457	14121	13789
3	17591	17231	16873	16519	16168	15819	15473	15129	14789	14451	14115	13784
4	17585	17225	16868	16513	16162	15813	15467	15124	14784	14446	14111	13778
5	17579	17219	16862	16507	16156	15807	15461	15118	14778	14440	14105	13773
6	17573	17213	16856	16501	16150	15802	15456	15113	14772	14435	14100	13767
7	17567	17207	16850	16496	16144	15796	15450	15107	14767	14429	14094	13761
8	17561	17201	16844	16490	16138	15790	15444	15101	14761	14423	14088	13756
9	17555	17195	16838	16484	16133	15784	15439	15096	14755	14418	14083	13750
10	17549	17189	16832	16478	16127	15778	15433	15090	14750	14412	14077	13745
11	17543	17183	16826	16472	16121	15773	15427	15084	14744	14407	14072	13739
12	17537	17177	16820	16466	16115	15767	15421	15079	14738	14401	14066	13734
13	17531	17171	16814	16460	16109	15761	15416	15073	14733	14395	14061	13728
14	17525	17165	16808	16454	16103	15755	15410	15067	14727	14390	14055	13723
15	17519	17159	16802	16449	16098	15749	15404	15061	14722	14384	14049	13717
16	17513	17153	16796	16443	16092	15744	15398	15056	14716	14379	14044	13712
17	17507	17147	16791	16437	16086	15738	15393	15050	14710	14373	14038	13706
18	17501	17141	16785	16431	16080	15732	15387	15044	14705	14367	14033	13701
19	17495	17135	16779	16425	16074	15726	15381	15039	14699	14362	14027	13695
20	17489	17129	16773	16419	16068	15721	15375	15033	14693	14356	14022	13690
21	17483	17123	16767	16413	16063	15715	15370	15027	14688	14351	14016	13684
22	17477	17117	16761	16407	16057	15709	15364	15022	14682	14345	14011	13679
23	17471	17111	16755	16402	16051	15703	15358	15016	14676	14339	14005	13673
24	17465	17105	16749	16396	16045	15697	15353	15010	14671	14334	14000	13668
25	17459	17099	16743	16390	16039	15692	15347	15005	14665	14328	13994	13662
26	17453	17093	16737	16384	16034	15686	15341	14999	14659	14323	13988	13657
27	17447	17087	16731	16378	16028	15680	15335	14993	14654	14317	13983	13651
28	17441	17082	16725	16372	16022	15674	15330	14988	14648	14311	13977	13646
29	17435	17076	16720	16366	16016	15669	15324	14982	14643	14306	13972	13640
30	17429	17070	16714	16361	16010	15663	15318	14976	14637	14300	13966	13635
31	17423	17064	16708	16355	16005	15657	15312	14971	14631	14295	13961	13629
32	17417	17058	16702	16349	15999	15651	15307	14965	14626	14289	13955	13624
33	17411	17052	16696	16343	15993	15646	15301	14959	14620	14284	13950	13618
34	17405	17046	16690	16337	15987	15640	15295	14954	14614	14278	13944	13613
35	17399	17040	16684	16331	15981	15634	15290	14948	14609	14272	13938	13607
36	17393	17034	16678	16325	15975	15628	15284	14942	14603	14267	13933	13602
37	17387	17028	16672	16320	15970	15623	15278	14937	14598	14261	13927	13596
38	17381	17022	16666	16314	15964	15617	15272	14931	14592	14256	13922	13591
39	17375	17016	16660	16308	15958	15611	15267	14925	14586	14250	13916	13585
40	17369	17010	16655	16302	15952	15605	15261	14919	14581	14244	13911	13580
41	17363	17004	16649	16296	15946	15599	15255	14914	14575	14239	13905	13574
42	17357	16998	16643	16290	15941	15594	15250	14908	14569	14233	13900	13569
43	17351	16992	16637	16284	15935	15588	15244	14902	14564	14228	13894	13563
44	17345	16986	16631	16279	15929	15582	15238	14897	14558	14222	13889	13558
45	17339	16980	16625	16273	15923	15576	15232	14891	14553	14217	13883	13552
46	17333	16974	16619	16267	15917	15571	15227	14886	14547	14211	13878	13547
47	17327	16968	16613	16261	15912	15565	15221	14880	14541	14205	13872	13541
48	17321	16963	16607	16255	15906	15559	15215	14874	14536	14200	13866	13536
49	17315	16957	16602	16249	15900	15553	15210	14869	14530	14194	13861	13530
50	17309	16951	16596	16243	15894	15548	15204	14863	14524	14189	13855	13525
51	17303	16945	16590	16238	15888	15542	15198	14857	14519	14183	13850	13519
52	17297	16939	16584	16232	15883	15536	15192	14852	14513	14177	13844	13514
53	17291	16933	16578	16226	15877	15530	15187	14846	14508	14172	13839	13508
54	17285	16927	16572	16220	15871	15525	15181	14840	14502	14166	13833	13503
55	17279	16921	16566	16214	15865	15519	15175	14835	14496	14161	13828	13497
56	17273	16915	16560	16208	15859	15513	15170	14829	14491	14155	13822	13492
57	17267	16909	16554	16203	15854	15507	15164	14823	14485	14150	13817	13486
58	17261	16903	16549	16197	15848	15502	15158	14818	14480	14144	13811	13481
59	17255	16897	16543	16191	15842	15496	15153	14812	14474	14138	13806	13475
60	17249	16891	16537	16185	15836	15490	15147	14806	14468	14133	13800	13470





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